BLACK BOX®
NETWORK SERVICES

SCAN-LAN VI

AUTOTEST

QUICK √   PRINT

WIRE
MAP   CAL

                   SETUP

LENGTH   EXTENDED
                FUNCTIONS
     TRAFFIC REMOTE

SCAN-LAN VI

**FEDERAL COMMUNICATIONS COMMISSION
AND
INDUSTRY CANADA
RADIO FREQUENCY INTERFERENCE STATEMENTS**

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio communication. It has been tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be necessary to correct the interference.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This digital apparatus does not exceed the Class A limits for radio noise emission from digital apparatus set out in the Radio Interference Regulation of Industry Canada.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe A prescrites dans le Règlement sur le brouillage radioélectrique publié par Industrie Canada.

NORMAS OFICIALES MEXICANAS (NOM)
ELECTRICAL SAFETY STATEMENT

INSTRUCCIONES DE SEGURIDAD

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.

2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.

3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.

4. Todas las instrucciones de operación y uso deben ser seguidas.

5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc..

6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.

7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.

8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.

9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.

10. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.

11. El aparato eléctrico deberá ser connectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.

12. Precaución debe ser tomada de tal manera que la tierra fisica y la polarización del equipo no sea eliminada.

13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.

14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.

15. En caso de existir, una antena externa deberá ser localizada lejos de las lineas de energia.

16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.

17. Cuidado debe ser tomado de tal manera que objectos liquidos no sean derramados sobre la cubierta u orificios de ventilación.

18. Servicio por personal calificado deberá ser provisto cuando:

    A: El cable de poder o el contacto ha sido dañado; u

    B: Objectos han caído o líquido ha sido derramado dentro del aparato; o

    C: El aparato ha sido expuesto a la lluvia; o

    D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o

    E: El aparato ha sido tirado o su cubierta ha sido dañada.

TRADEMARKS

The trademarks mentioned in this manual are acknowledged to be the property of the trademark owners.

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1. Specifications

General

Display: 128 x 64 pixel backlit graphic LCD

Operating Controls: 10-position rotary function selector; Elastomeric keypad

Audible Alarm: Operator Enabled/Disabled

Compliance: Directive 89/336/EEC per TCF CC/KID/048/98

Operating Temperature: 32 to 122°F (0 to 50°C)

Storage Temperature: -4 to +140°F (-20 to +60°C)

Relative Humidity: 10 to 90%, noncondensing

MTBF: >50,000 hours

Size: 9.6 H" x 3.9 W" x 2.5D" (24.4 x 9.9 x 6.4 cm)

Weight: 1 lb., 15 oz. (0.88 kg)

Power

Battery: (8) AA alkaline batteries per unit or (1) NiMH rechargeable battery pack per unit

Battery Life: 8 to 10 hours of continuous use or >800 Autotests (typical)

Low Battery Indicator: Audible alarm plus LCD display

Automatic Power-Down: 2 to 30 minutes (selectable) or disabled

AC/Mains Adapter (Battery Eliminator): 12 to 15 VDC, 300 mA

Input: 120 or 230 VAC ±15%

Output: 60 or 50 Hz

Frequency: 12 or 14 VDC

Lithium Coin Cell (Autotest Results Storage) Life: 2 years

Performance Modules

Performance Module inputs withstand telco ring voltages; 175V peak, 20–60 Hz superimposed on 56 VDC, maximum. They also withstand electrostatic discharges per IEC 801-2 severity level 4 (8KV contact).

Standard: Modular Plug (TS691 or TS691E)

Optional: Modular Jack (TS692)

Optional: Coax (TS693)

Memory

Test Storage: Storage of up to 450 Autotest results plus one Traffic Report in each SCAN-LAN VI

Imprint: Date on all tests

Non-Volatile Memory: Lithium battery-backed memory for setup, test results, and NVP values

Wire Mapping (Twisted-Pair Wiring Only)

Displays Following Errors: Miswired Pairs, Shorts, Opens, Shorted Pairs, Crossed Pairs, and Split Pairs. Includes test of shield (if present)

Traffic (Ethernet Only)

Parameters Monitored: % Utilization, % Collisions, Peak Traffic

Other Features: Continuous bar graph to display activity

Attenuation-to-Crosstalk Ratio

ACR is calculated for each pair over the full frequency range per test specification selected

Serial Port

Connector: DB9 male (pins)

PC Cable: Null modem, DB9 female (socket) to DB9 female (socket) and DB25 female serial port pin assignments:

```
                              1 No connection
          SERIAL PORT         2 Receive data (input)
                              3 Transmit data (output)
       9  ┌─────────┐  6      4 Data terminal ready (output)
          │ ○○○○    │         5 Signal ground
       5  │ ○○○○○   │  1      6 No connection
          └─────────┘         7 No connection
                              8 Clear to send (input)
                              9 No connection
```
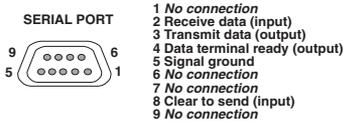
Baud Rate: 1200 to 38,400 bps (selectable)

Format: 8-bit, no parity, 1 stop bit (8N1)

Flow Control: X-ON/X-OFF, Hardware (CTS/DTR), None

Cable Length

Range: 0 to 2000 ft. (0 to 610 m) over twisted pair

Accuracy:

$\pm$2 ft. (0.6 m) $\pm$2% $\pm$NVP Uncertainty 0 to 1000 ft. (0 to 304.8 m)

$\pm$2 ft. (0.6 m) $\pm$3% $\pm$NVP Uncertainty 1001 to 2000 ft. (305.1 to 610 m)

NVP (Nominal Velocity of Propagation): 0.5 to 0.99%

Cable Fault Types: Shorts, Opens, Intermediate Impedance Anomalies

Number of Faults Measured: End of cable and two intermediate anomalies

Fault Threshold: User-defined, 4 to 10% (7% default)

Talk and Test Module for the SCAN-LAN IV

Supported Standards and Network Applications: TIA 568A, ISO 11801/EN 50173, IEEE 802.3 (10BASEFB, 10BASEFL, 10BASEFP, 10BASEFX, 100BASEFX), IEEE 802.5 (Token Ring), IEEE P802.37/D4 (1000BASESX [Gigabit Ethernet], 1000BASELX [Gigabit Ethernet]), IEEE 802.12 (100VG AnyLAN), ISO/IEC 9314-3 (FDDI), ATM 100, ATM 155, ATM 155 SWL, ATM 622, ATM 622 SWL

Length: 6600 ft. (2011.7 m)

Resolution: 1 ft. (0.3 m)

Length Accuracy: 0 to 1000 ft. (0 to 304.8 m) ±2 ft. (0.6 m) ±2% IR Uncertainty; 1001 to 6600 ft. (305.1 m to 2011.7 m) ±2 ft. (0.6 m) ±3% IR Uncertainty

Propagation Delay: 10 to 10,000 ns

Optical Loss: *Dynamic Range:* +3 dBm to -55 dBm; *Resolution:* 0.01 dB; *Accuracy:* ±0.3 dB @ -20 dBm

Operating Temperature: 32 to 122°F (0 to 50°C)

Storage Temperature: -4 to +140°F (-20 to +60°C)

Humidity Tolerance: 10 to 90%, noncondensing

Power: Derives power from the SCAN-LAN VI

Weight: 5.1 oz. (144.6 g)

2. Introduction

The SCAN-LAN VI is a testing system that troubleshoots and certifies LAN cable installations. Along with 250 MHz Performance Modules (included or ordered as part number TS691), the SCAN-LAN VI consists of two handheld units, one functioning as a main unit, and the other as a remote unit. It also features LinkTalk voice communications across twisted-pair test links. Each unit has a built-in microphone and earphone jack.

The Performance Modules take Category 5 testing beyond current Category 5 standards of 100 MHz, providing critical information for enhanced CAT 5 and Gigabit cabling. The SCAN-LAN VI offers an unequaled combination of power and measurement precision—and it's easy to use and inexpensive. The unique modular design makes SCAN-LAN VI the most versatile tester on the market.

In addition to being fully compliant with TIA TSB 67 requirements for certifying CAT 5/Class D links, the SCAN-LAN VI performs several important new measurements including Power Sum Near End Crosstalk (PS-NEXT) and Power Sum Attenuation-to-Crosstalk Ratio (PS-ACR) to 250 MHz.

Padded protective overcases supplied with the system enclose both the tester and performance module, protecting them from damage in the field while allowing full access to the display and all controls.

The Talk and Test Module for the SCAN-LAN IV certifies multimode fiber in pairs by comparing bi-directional dual-wavelength 850/1300 nm loss, length, and propagation delay measurement against several industry standards.

2.1 Packing List

Description	Part Number
(2) SCAN-LAN VIs	TS6000A or AE
(2) Test and Talk Modules	TS6001A
(Also, 2 ST to ST duplex patch cables, 1 hard carrying	
case, 2 built-in microphones, 2 individual earphones, and	
Report Manager Software.)	
(2) Modular Plug Performance Modules (installed)	TS691 or TS691E
PC Interface Cable	——
AA Alkaline Batteries, 8 for each unit (installed)	——
(2) Battery Eliminators (AC/Mains Adapter)	TS694 * (see NOTE)
(2) LinkTalk earphones	——
Report Manager Software	——
Calibration standard and coupler	——
(2) Handset cases	——
Carrying Case	——
User's Manual	——

*NOTE

The Battery Eliminators provided may differ in various countries. See the optional accessories list in Appendix C.

2.2 Features

2.2.1 TESTING FEATURES

- Tests UTP, ScTP, coaxial, STP, and fiberoptic cable.

- Certifies twisted-pair cable up to EIA/TIA 568A Category 5 and ISO/IEC 11801 Class D (100 MHz).

- Performs NEXT, Length, Wire Map, Attenuation, Noise, Traffic, Impedance, and Resistance tests.

- Performs a preprogrammed set of certification tests when the rotary dial on the front of the unit is set to "Autotest."

- Performs enhanced cable tests including Power Sum NEXT, Delay/Delay Skew, headroom, and link-performance analysis to test emerging new enhanced data cables.

- Cable Toner enables identification of cable at far end.

2.2.2 CABLE STANDARDS SUPPORTED TO 250 MHz

- TSB-67 Basic Link, CAT 5

- TSB-67 Channel, CAT 5

- ISO 11801 Class D

- ScTP Class D

- AS/NZS 3080 Class D

- BICC Millennium

- FTP 120 Ohms

- JIS X 5150

Two SCAN-LAN testers are required for 250-MHz tests and all Remote NEXT tests.

NOTE FOR USERS OF OLDER SCAN-LAN TESTERS

Firmware versions below 6.00 require factory calibration before running 250-MHz tests. Contact Black Box for factory-calibration details.

Cable Grading is not available for firmware versions 6.00 B3/B4 or higher. Cable grading has been superseded by headroom and link-performance analysis detail screens.

2.2.3 NETWORK STANDARDS SUPPORTED AT 250 MHz

- IEEE 100BASE-Tx

- ANSI X3T9.5 TP-PMD

- ATM 155 Mbps

2.2.4 SPECIAL FEATURES OF THE SCAN-LAN VI

- Test reports can be saved in three different formats:

  - Encrypted tamper-proof Report Manager format.

  - Comma Separated Variable for import into spreadsheet programs.

  - Text files for import into word-processing programs.

- Stores results of up to 450 Autotests.

- Graphical user interface on the main and remote units, allowing test results to be viewed at both ends.

- Backlit LCD display.

- Easy field updates of hardware and software using plug-in Performance Modules and flash memory.

- Operates using either replaceable AA batteries, AC/mains power, or a rechargeable NiMH battery pack.

- Voice communication between main unit and the remote.

The SCAN-LAN VI's features, and how they are used, are described below.

Performance Module plugs in for user-selectable cable test configurations.

Function buttons (F1, F2, F3, and F4) are software defined. Their operation depends on the selected function, as indicated by the labels in the display.

Up and down arrows scroll through menus and change cable test standards. Also adjusts contrast in conjunction with the backlight control button.

ENTER selects the choice that is highlighted.

ESC (Escape) aborts the current action or returns to the previous screen.

Power on and off control.

LCD backlight control. Also adjusts contrast in conjunction with the up and down arrows.

Rotary dial selects a test or function.

SERIAL PORT cable connection to upload test reports to a printer or a computer. Also to download new firmware.

12-15 VDC connector to plug in the ac adapter.

(bottom)

Tests and functions accessible using the rotary dial are described below.
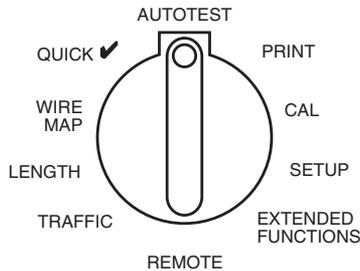
Dial Position	Function
AUTOTEST	Performs a preprogrammed set of tests, which are required to certify a cable installation.
PRINT	Print, view, or upload to PC, Autotest, or Traffic reports.
CAL	Calibrate cable NVP, Performance Module, and Remote.
SETUP	Changes operation characteristics including Time/Date.
EXTENDED FUNCTIONS	Individual cable tests, unit self-test, pair-reversal test, repeatability test, and flash memory download.
REMOTE	Puts the SCAN-LAN VI into remote mode.
TRAFFIC	Monitors traffic activity on an Ethernet network.
LENGTH	Determines the cable length and up to two intermediate anomalies.
WIRE MAP	Determines pin-to-pin continuity, shield continuity, and split pairs.
QUICK √	Performs an abbreviated Autotest test sequence as a fast cable-installation check.

2.2.5 SEND FUNCTION

The Send function transmits on-screen test results to the unit at the other end. To use the Send function, simply complete the test, and when the screen you want to transmit is displayed, press the corresponding soft function key. For example, in the figure below, you would press F1 to send the results.

2.2.6 LINKTALK FUNCTION

The LinkTalk function allows two-way voice communication between the main unit and the remote. LinkTalk uses a microphone embedded in the front of each unit and an earphone connected to the jack on each unit's side. See **Chapter 4**, **Autotest**, for details.

2.2.7 PERFORMANCE MODULE

The SCAN-LAN VI is designed with removable performance modules for attaching to various cable types and cable connectors. The key to the SCAN-LAN VI's high measurement accuracy is using the proper performance module.

To remove a module, loosen the thumbscrews on either side of the module until the screws are free of the retainers. Hold the module on either side and slide it out of the opening (see the figure on the next page).

To install a module, slide it into the opening until the screws rest against the retainers. Hand-tighten the screws until the module is securely attached.

CAUTION

Avoid damaging the SCAN-LAN VI's case. Tighten the screws evenly using finger pressure only. Make sure to either turn both screws simultaneously or alternately in small increments. The module is designed to be installed or removed without tools.
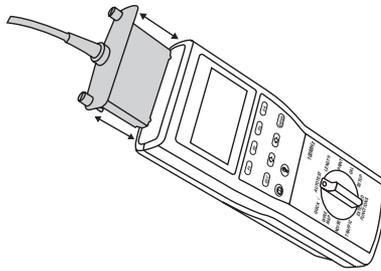
Removing or installing the performance module.

BEWARE OF STATIC ELECTRICITY!

The SCAN-LAN VI contains static-sensitive electronics inside the main body. Use appropriate precautions when removing and installing performance modules.

2.3 Battery Information

The SCAN-LAN VI handheld is shipped with 8 AA alkaline batteries per unit.

Two rechargeable nickel metal hydride (NiMH) battery eliminators are also included.

A low battery message appears on the LCD screen when it is time to replace the batteries. When this message appears, you have 60 seconds to save your test results before the unit automatically powers down.

2.3.1 MEMORY STORAGE

The SCAN-LAN VI's memory is powered from an internal, long-life lithium cell. Stored test results and setup conditions will therefore be saved when you replace the AA alkaline batteries or rechargeable battery eliminator.

2.3.2 CHARGING MODE

When the AC/Mains adapter is used and the SCAN-LAN VI is powered "off," the unit goes into a "sleep mode." With the NiMH re-chargeable battery eliminator installed, the unit goes into a Recharge mode. A fully discharged battery eliminator will take approximately 10 to 12 hours to charge to full capacity. To resume testing, press the Power button.

2.3.3 CHANGING THE BATTERIES

To change the SCAN-LAN VI's batteries:

1. Remove the battery-compartment cover on the back by pushing the tab in and then up.
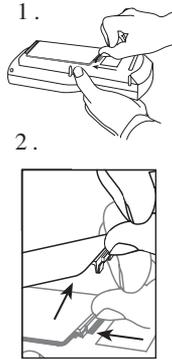
2. Remove the batteries.

3. Install new batteries. Pay attention to the polarity markings on the inside of the battery well.

NOTE

The FAIL LED on the Remote Unit blinks continuously when the battery is low.

2.3.4 USING THE RECHARGEABLE BATTERY ELIMINATOR

When installing the battery eliminator, insert the battery eliminator with the label side out.

The battery eliminator is charged by plugging in the external power supply while the SCAN-LAN VI is OFF. To charge the batteries, turn the SCAN-LAN VI OFF and connect the external power supply. The display will show "SCAN-LAN VI," the serial number of the unit, the date, the time, and the message "RECHARGING." When the battery is fully charged (up to 14 hours), the "RECHARGING" indication will go away. Note that the SCAN-LAN VI will not charge the batteries when it is ON.

One of the advantages of a NiMH battery is that *it does not have the "memory" characteristics of a NiCd battery.* You do *not* need to completely discharge or cycle the battery to maintain full capacity.

Like NiCd batteries, the NiMH batteries do self-discharge over time. After storage for several weeks, they may have only a fraction of their initial charge. The rate of self-discharge is dependent on temperature: Self-discharge is slower at lower temperatures. We recommend charging the battery pack the night before any planned use.

Note that the "RECHARGING" message should ALWAYS appear for at least a short period at the beginning of the charging process. If the battery pack is completely charged, the message will then go away. If the unit is turned OFF while using the external power supply and the message "RECHARGING" does not immediately appear, the charging function is not working properly. Contact Black Box.

If you have any problems recharging the battery pack, or you have any other problems or questions, call Black Box.

2.4 Display Conventions

2.4.1 ARROW KEYS

An up/down arrows symbol ↑↓ (see detail below) appears next to an item on the LCD display to indicate that you can use the arrow keys to make a different selection. For example, in the figure below, the arrows appear next to the word "Link" on the screen.
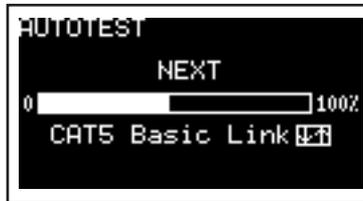
To change a selection,

1. Press the up or down arrow key to scroll through the available selections.

2. When the choice you want is highlighted, press SAVE (F4) or ENTER.

2.4.2 SCROLL BARS

When there are more selections available than can fit on one SCAN-LAN VI screen, scroll bars will appear. For example, in the figure below, the scroll bar appears above "Save."

To use the scroll bar, press the arrow keys to move the scroll-bar indicator as well as to highlight a new selection.

2.4.3 DISPLAY CONTRAST ADJUSTMENT

Hold down the Backlight button and press the arrow keys to set the screen contrast for comfortable viewing.

3. Getting Started

This chapter provides a brief overview of how to use the SCAN-LAN VI for testing twisted-pair cabling. It is intended for users with prior cable-testing experience who want to get started quickly. It covers only the basics of initial setup, connections to the cable, and the Autotest function. If you have *no* prior cable-testing experience, review **Chapter 8, Testing Twisted-Pair Cable,** before using this instrument.

3.1 Initial Setup

Before you first use the SCAN-LAN VI, you should check SETUP. SETUP controls many basic instrument operations such as power-down time, backlight "on" time, feet/meters, date, time, and serial-output format. Each of these settings has a "default" value established by the factory. To adjust any of these settings, refer to **Chapter 9, Setup**.

3.1.1 SETTING UP THE SCAN-LAN VI

To set up the SCAN-LAN VI:

1. Set the remote unit's dial to REMOTE.

2. Press the remote unit's power button on. The display will read:

```
REMOTE

    CAT5 Basic Link
```

3. Set the main unit's dial to the test or function you want to perform.

4. Connect it to the cable to be tested.

5. Press the main unit's power button on.

6. When the test has completed, the remote unit's screen will show either PASS or FAIL. If the test passes, the remote unit displays:

```
REMOTE
  PASS
CAT5 Basic Link
```

If the test does not pass, the remote unit displays:

```
REMOTE
  FAIL
CAT5 Basic Link
```

3.1.2 NVP CALIBRATION

A typical NVP value will be automatically selected by the SCAN-LAN VI, depending on the test standard that you choose. For greater measurement accuracy, follow the NVP calibration procedure in **Chapter 10, Calibration**.

3.1.3 WHY DO I NEED TO SET CABLE NVP?

In order to make accurate cable-length measurements, the correct cable Nominal Velocity of Propagation (NVP) value must be set in the SCAN-LAN VI.

The NVP is a measure of how fast an electrical pulse travels down a cable compared to the speed of light. NVP is expressed as a percentage and is usually between 50 and 90%. A default NVP value is automatically set by the SCAN-LAN VI based on the cable test standard selected.

Using the default value, however, may result in cable-length measurement errors of up to 7%, due to the variation in the signal-propagation rate from cable to cable. This potential length error usually won't impair troubleshooting of a prior working cable segment unless the length measurement of a cable is close to the test limit (for example 100 meters on a 10BASE-T segment).

When using the SCAN-LAN VI for cable certification, determine the true cable NVP and save the value. This will ensure the most accurate cable-length measurements and will avoid failing cable segments that are close to the test limit.

3.2 Typical Test Setup

3.2.1 BASIC-LINK TESTING

The figure below illustrates a typical test setup using a SCAN-LAN System to test a Basic Link, as defined by TIA/EIA TSB-67.
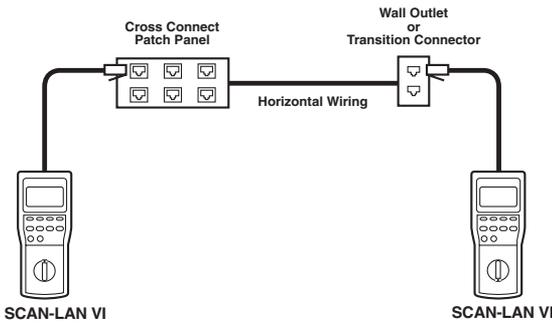
NOTE

To certify a cable link with Level-II accuracy, you must test the Basic Link using the SCAN-LAN Modular Plug Performance Module. You must also test the link from both ends. See Appendix A, Test Standards, for more information.

3.2.2 CHANNEL TESTING

The figure below illustrates a typical test setup using a SCAN-LAN System to test a Channel as defined by TIA/EIA TSB-67.
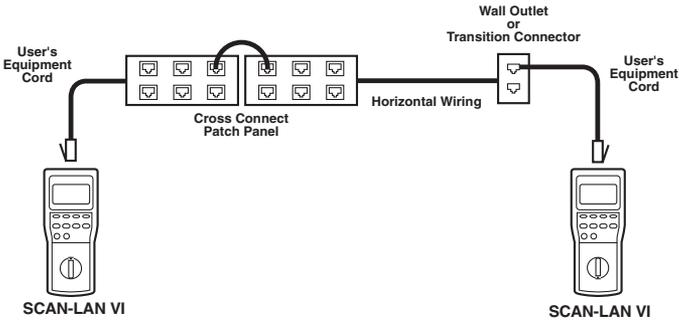
NOTE

A channel can be certified for conformance to the TIA/EIA TSB-67 Link Performance Standard; however, accuracy will be less than Level-II requirements for a Basic Link. See Appendix A, Test Standards, for more information.

3.3 Selecting a Cable Test Standard

The Cable Test Standard used by the SCAN-LAN VI to certify cables may be changed whenever the up/down arrows symbol appears next to the cable name. (See the illustration below.)
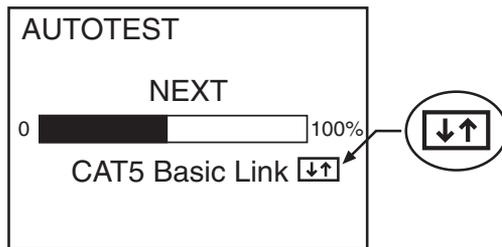
To select a different cable test standard:

1. Set the dial to Autotest, Quick √, Wire Map, Length, or Traffic.

2. Press either arrow key to display the cable-standard library and select a different cable test standard.

3. When the desired cable test standard is highlighted, press SELECT (F4) or Enter. The SCAN-LAN VI immediately begins testing using the new cable test standard.

NOTE

Refer to Appendix A, Test Standards, for assistance in choosing an appropriate cable test standard. This chapter explains when to select a cable standard and when to select a network standard.

When using a SCAN-LAN VI System, cable standards are compared at both ends. If they differ, the standard on the remote end will be changed to match that of the main end.

3.4 Defining Custom Standards

Existing cable test standards can be modified to create a maximum of 23 additional custom standards. Custom standards are initially labeled as Custom #1 and Custom #2. Once you have defined a new standard, it appears in the cable-standard library identified by an asterisk (*).

The tests performed and the PASS/FAIL limits are set by copying one of the existing cable test standards. The customization consists of selecting which pairs will be included in the test and whether or not the shield is required to be present for the Wire Map to PASS.

To create a custom standard:

1. Set dial to Autotest, Quick √, Wire Map, Length, or Traffic.

2. Press either arrow key to display the cable-standard library and highlight one of the two custom cable test standards.

```
CHANGE CABLE STANDARD
RG-59                        ▲
RG-59  Foam
RG-62  (Arcnet)
FIBER
*CAT5  Channel
*CAT5  Channel
CANCEL     EDIT       SAVE
```

(F1)   (F2)   (F3)   (F4)

3. When the custom cable test standard is highlighted, press EDIT (F2).

4. Choose a cable standard to copy from the list of standards by pressing either arrow key. Press COPY (F4) or ENTER to copy the standard. Press SKIP (F2) if you are modifying a previously entered custom cable and don't want to copy another standard.

```
┌──────────────────────────────┐
│     EDIT CUSTOM CABLE        │
├──────────────────────────────┤
│ Copy from:                 ┌─┐│
│ ▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓    │ ││
│ CAT5  Channel              └─┘│
│ CATS Basic Link              │
│ CAT4 Channel                 │
│ CAT4 Basic Link            ┌▼┐│
├────────────────────────────┴─┤
│ CANCEL     SKIP         COPY  │
└──────────────────────────────┘
```

   (F1)   (F2)   (F3)   (F4)

5. Press SELECT/DESELECT to choose wire pairs and shield. Press either arrow key to move up or down the list. Selected pairs (indicated by a √ mark) will be included in the custom test.

```
┌──────────────────────────────┐
│        Select Pairs:         │
├──────────────────────────────┤
│  ✓  ▓▓▓▓▓▓▓▓▓▓▓▓▓             │
│  ✓  PAIR 1  (1-2)            │
│  ✓  PAIR 2  (3-6)            │
│  ✓  PAIR 3  (4-5)            │
│  ✓  PAIR 4  (7-8)            │
│     SHIELD                   │
├──────────────────────────────┤
│ DESELECT              SAVE    │
└──────────────────────────────┘
```

   (F1)   (F2)   (F3)   (F4)

6. Press SAVE (F4) or ENTER to save the custom standard. To cancel, press ESC.

NOTE
Matching custom cable definitions must be created on both units.

3.5 System Integrity Pre-Test

Before testing an installation, the integrity of the SCAN-LAN VI system may be checked by running these tests.

To pre-test your system:

1. Connect the main and remote units using a CAT3 coupler or a patch cable.

2. Run Self-Test.

3. Run Pair Reversal.

4. Run Repeatability.

5. Run Autotest.

6. If FAIL occurs on any test result, call Technical Support at 724-746-5500.

4. Autotest

Autotest is a preprogrammed set of tests which are required to certify a cable installation. All of the tests performed by Autotest can also be performed individually.

Autotest performs these tests: Wire Map, Near-End Crosstalk (NEXT) at both ends for Two-Way testing, Attenuation, ACR, and Length. The following tests may be added to the Autotest suite of tests by defining a custom cable standard: Impedance, Delay/Delay Skew, 250 MHz UTP, Power Sum Link Performance, Power Sum NEXT, Power Sum ACR, Cable Grading, and Resistance.

NOTES ON 250-MHz TESTING

• 250-MHz testing is available for all 100-MHz tests. This option is available by entering the CHANGE CABLE STANDARD menu and editing the selected test standard. Using this option, the instrument will extend NEXT and ATTENUATION measurements out to 250 MHz.

• PASS or FAIL indications when running Autotest are based on existing 100-MHz test standards.

• 250-MHz tests can also be enabled by selecting "250 MHz UTP" in the Cable Standard menu.

• If the SCAN-LAN fails any test, it will stop and display the failure. You may continue testing by pressing the CONTINUE (F4) softkey.

Refer to **Chapter 6, Cable Test Descriptions**, for a complete description of these and other tests performed by the SCAN-LAN VI.

Refer to **Chapter 7, Printing, Uploading, and Viewing Test Results**, for more information about printing test results and uploading test results to a PC.

4.1 Running Autotest

1. Connect one end of cable to the main unit and the other end to the remote unit.

2. Set the remote unit's dial to REMOTE.

   Set the main unit's dial to AUTOTEST. The test runs automatically, then displays the results. (Press the arrow keys to change the cable test standard.)

3. Press Start (F1) to re-start Autotest. Press VIEW (F3) to review Autotest test results.
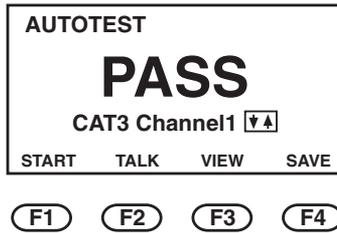
4. Press SAVE (F4) or ENTER to save the Autotest test results.

5. Press TALK (F2) to ring the Remote Unit at the other end.

NOTE

If the SCAN-LAN VI fails any test, it will stop and display the failure. You may continue testing by pressing the CONTINUE (F4) softkey.

4.2 Viewing Autotest Results

Autotest results are displayed in either summary or detailed mode.

This section describes a general procedure for reviewing Autotest results including summary screens for Wire Map, NEXT, Attenuation, ACR, Length, and Propagation Delay tests, and detailed test results for NEXT and Attenuation. Refer to **Chapter 6, Cable Test Descriptions**, for more information on interpreting test-result screens.

4.2.1 SUMMARY RESULTS

1. Press View (F3) from the Autotest results screen. (Press the arrow keys to view additional summary test-result screens.)

2. Press SAVE (F4) or ENTER at any time to save the Autotest results.

3. Press SEND (F1) to send the results to the remote unit.

4. Press ESC to exit View.

NOTE

The Send function appears above the F1 key. Press F1 to send the information to the remote end.

4.2.2 MARGINAL TEST RESULTS

A PASS* or FAIL* result indicates that a measured NEXT or attenuation value is close enough to the Test Standard that it is within the measurement uncertainty of the SCAN-LAN VI. As a result, the PASS or FAIL judgment is uncertain, and therefore the SCAN-LAN VI cannot determine with confidence whether the link conforms to the Test Standard.

To resolve link tests with marginal measured results:

1. Reduce the measurement uncertainty. If you are currently using a Level I-rated Performance Module (PM), replace it with a Level II-rated PM and retest. If the test result is still marginal, or if you are already using a Level II-rated PM, go to the next step.

2. Recheck the link installation, focusing on connection points. Refer to **Chapter 8, Testing Twisted-Pair Cable**, for suggestions on causes for excessive NEXT and attenuation. Correct the installation if possible, and retest.

4.2.3 DETAILED RESULTS

Some test-result screens (for example, the NEXT summary screen) have a DETAIL softkey that you can press to view more information about the test results.

1. Press DETAIL (F3) from the Autotest results screen.

2. Press SUMMARY (F3) to return to the test-result SUMMARY screen.

3. Press SAVE (F4) or ENTER at any time to save the Autotest results. (For a discussion of GRAPH [F2], refer to **Section 6.2.5**.)

4. Press SEND (F1) to send results to the remote unit.

NEXT	MHz	dB	Spec
12/36	32.7	31.1	29.8
12/45	31.1	24.7	30.0
12/78	51.7	41.7	34.0
36/45	18.7	47.6	41.1
36/78	36.3	34.0	23.6
45/78	32.2	33.1	29.3
SEND	GRAPH	SUMMARY	

| F1 | F2 | F3 | F4 |
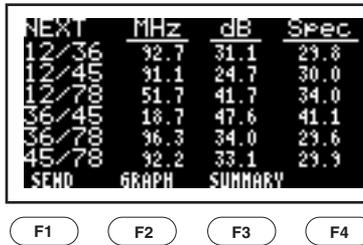
4.3 Viewing 250-MHz Autotest Results

After performing an Autotest, SCAN-LAN will display PASS, FAIL or PASS*, FAIL*. SCAN-LAN also displays Headroom and Crossover.

Headroom (expressed in Decibels or dB) is based on the worst-case measurement of Power Sum NEXT relative to the NEXT standard for the cable test chosen. Crossover value (in MHz) is the frequency at which Power Sum ACR equals zero (PSNEXT-Attenuation = PSACR).

Two test-summary screens are shown after an Autotest: Link Performance and Power Sum ACR.

VIEWING TEST RESULTS

1. After completing Autotest, press VIEW (F3) from the Autotest results screen.

2. Press the arrow keys to view additional summary test-result screens (Link Performance and PSACR are shown after the NEXT results).

3. Press SAVE (F4) or ENTER at any time to save the Autotest results.

4. Press GRAPH (F2) to view a graphic display of the test results.

5. Press SEND (Fl) to send the results to the Remote Unit.

6. Press ESC to exit View.

4.3.1 LINK PERFORMANCE SCREEN

The Link Performance screen provides additional cable performance information. This screen displays Headroom (HR) and the Power Sum Attenuation to Crosstalk Ratio (PS-ACR) for all four wire pairs.

```
LINK PERFORMANCE
          HR   ACR=10dB  ACR=0dB
  1,2  22.9dB   >250MHz  >250MHz
  3,6  15.8dB  151.8MHz  >250MHz
  4,5  16.5dB  165.3MHz  >250MHz
  7,8  22.6dB   >250MHz  >250MHz
SEND                        SAVE

  ( F1 )   ( F2 )   ( F3 )   ( F4 )
```
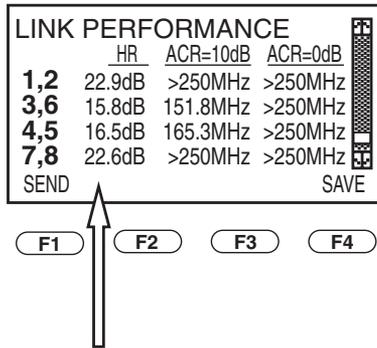
HEADROOM

Headroom (HR) is displayed in decibels (dB) and indicates the measured difference between actual cable performance and current Category 5 standards. A high dB value for Headroom indicates a level of performance better than Cat 5.

4.3.2 POWER SUM ACR

Power Sum Attenuation to Crosstalk Ratio (PS-ACR) is displayed two ways. The column ACR=10 dB indicates the frequency at which the pair tested had an ACR value of 10 dB. This is generally accepted to be the usable bandwidth of the cable while still having enough signal strength to guarantee low data-transmission error rates. The column ACR=0 dB indicates the frequency at which ACR measured zero. This zero point is considered the absolute maximum usable bandwidth of the cable.

```
        ↓              ↓
┌─────────────────────────────┐
│ LINK PERFORMANCE         ▓  │
│       HR   ACR=10dB ACR=0dB ▓│
│ 1,2  22.9dB  >250MHz >250MHz▓│
│ 3,6  15.8dB 151.8MHz >250MHz▓│
│ 4,5  16.5dB 165.3MHz >250MHz▓│
│ 7,8  22.6dB  >250MHz >250MHz▓│
│ SEND                    SAVE │
└─────────────────────────────┘
  ( F1 )  ( F2 )  ( F3 )  ( F4 )
```
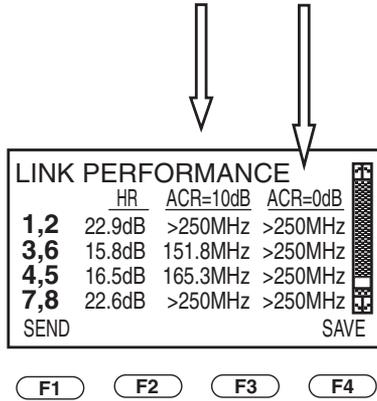
4.4 Saving Autotest Results

Each SCAN-LAN VI can store the results of up to 450 Autotests, which can later be uploaded to a PC or printer. Refer to **Chapter 7, Printing, Uploading, and Viewing Test Results**, for the discussion on how to output test results.

To save Autotest results:

1. Press Save (F4) or ENTER, from the Autotest Summary screen or any VIEW screen. The SCAN-LAN VI automatically selects the next report number. You can change the number by pressing the arrow keys.

2. If desired, enter a circuit identification number (refer to the detailed instructions that follow).

3. Press ENTER.

```
┌─────────────────────────────┐
│ AUTOTEST SAVE               │
│        Report #001▯         │
│   (Press ENTER to Save)     │
│                             │
│     ID: TEST-▯              │
│                             │
│ LEFT    PREV    NEXT   RIGHT │
└─────────────────────────────┘
  ( F1 )  ( F2 )  ( F3 )  ( F4 )
```

NOTE

Either unit may save up to 450 Autotests, giving the SCAN-LAN VI System the capability of saving 900 Autotests. After you have saved 450 Autotests in the main unit, you can switch units, use the remote as the main unit, and save 450 more Autotests.

CAUTION

If you choose a report number that is in use, the message "In use" is displayed.

The SCAN-LAN VI has no overwrite protection. Nothing prevents you from saving a report to the same number as a previous report number and erasing the earlier one.

ENTERING A CIRCUIT IDENTIFICATION NAME

To change circuit identification:

1. The SCAN-LAN VI will display a default circuit identification unless the circuit ID is disabled by the Setup routine. To speed up entering circuit identifiers, the SCAN-LAN VI can automatically increment the last circuit identifier.

2. Press LEFT (F1) or RIGHT (F4) to move the cursor left or right along the ID line.

3. Press PREV (F2) or NEXT (F3) to enter letters or numbers.

4. Press ENTER to save or press ESC to quit without saving.

After saving, a message in the upper right corner of the screen displays the saved report number (for example, "Saved #001").

Autotest report details remain available for viewing until the next test is started.

NOTE

Autotest results will be lost if not saved before the SCAN-LAN VI powers down.

4.5 LinkTalk

LinkTalk temporarily converts the SCAN-LAN VI system to an audio-communication system. LinkTalk enables bi-directional, one-way (half-duplex) voice communication between the main unit and the remote.

1. Attach earphones to the jacks on the lower right sides of both main and remote units.

2. LinkTalk can be activated following Autotest or Quick Check, or from the Extended Functions menu. Press TALK (F2) from the Autotest or Quick Check summary screen, or select TALK from the Extended Functions menu. This will cause the remote to enter the TALK mode.

```
┌──────────────────────────┐
│ AUTOTEST                 │
│      PASS                │
│   CAT3 Channel1 ▼▲       │
│ START   TALK   VIEW  SAVE│
└──────────────────────────┘
     (F1)  (F2)  (F3)  (F4)
```

3. When the remote unit enters TALK mode, an alert bell will ring. Press STOP RING (F3) or any other defined function button on the remote unit to stop the bell.

```
┌─────────────────────────────────┐
│ LinkTalk                        │
│                                 │
│             LISTEN              │
│  Volume: ████████████           │
│    ▼▲                           │
│              STOP     PUSH TO   │
│              RING      TALK     │
└─────────────────────────────────┘
```

(F1)   (F2)   (F3)   (F4)
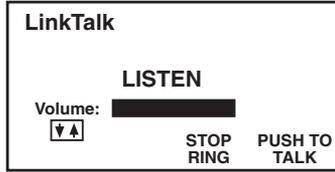
4. Press PUSH TO TALK (F4) on either the main or remote to talk to the other person at the other end of the cable.

```
┌─────────────────────────────────┐
│ LinkTalk                        │
│                                 │
│             LISTEN              │
│  Volume: ████████████           │
│    ▼▲                           │
│                       PUSH TO   │
│                        TALK     │
└─────────────────────────────────┘
```

(F1)   (F2)   (F3)   (F4)

5. Press the arrow keys to adjust earphone volume up or down.

6. Press ESC to exit TALK mode.

4.5.1 INTERACTION OF TALK AND SEND FUNCTIONS

After sending a test result screen to the Remote using the SEND button, the TALK feature can be activated as shown below, making it easy for the operators to discuss the result.

1. From an Autotest Summary Screen, send the test-result screen to the Remote using the SEND button.

2. On the Main unit, press the ESC key to return to the overall Autotest summary screen.

3. Enter the TALK mode by pressing the TALK button (F4).

4. On both units, a REVIEW (F1) softkey is displayed. Press REVIEW (F1) to view the test-result screen.

5. Press PUSH TO TALK (F4) to talk to the person at the Remote end.

6.   Press ESC to return to the TALK mode screen.

4.5.2 SYSTEM INTEGRITY PRE-TEST

Before testing an installation, the integrity of the SCAN-LAN VI system may be checked by running the tests described below.

To pre-test your system:

1.   Connect the main and remote units using a CAT3 coupler or a patch cable.

2.   Run Self Test.

3.   Run Pair Reversal.

4.   Run Repeatability.

5.   Run Autotest.

6.   If FAIL occurs on any test results, call Technical Support for assistance.

5. Quick Check

Quick Check is an abbreviated Autotest, designed to be completed in less than 10 seconds. It's used for quick installation checks.

Quick Check performs these tests on twisted-pair cables: Wire Map, Near-End Crosstalk (NEXT) at both ends for Two-Way testing, Attenuation, ACR, and Length. These additional tests may be added to the Quick Check suite of tests by defining a Custom Cable standard: Impedance, Propagation Delay/Delay Skew, Power Sum NEXT, Cable Grading, and Resistance.

NEXT and Attenuation tests take measurements at a reduced number of test points covering the entire frequency range. For this reason, Quick Check is not a cable certification test; *the results cannot be saved.*

5.1 Running Quick Check

1. Connect one end of the cable to the main unit and the other end to the remote unit.

2. Set the remote unit's dial to REMOTE.

3. Set the main unit's dial to Quick √. The test begins automatically. (Press the arrow keys to change the cable test standard.)

4. Press Start (F1) to re-start Quick Check. Press VIEW (F3) to review Quick Check test results.

5.2 Viewing Quick Check Results

Viewing the results of Quick Check is the same as for Autotest, except that they cannot be saved. Refer to **Section 4.2**.

MARGINAL TEST RESULTS

A PASS* or FAIL* result (PASS or FAIL with an asterisk) indicates that a measured NEXT or attenuation value is close enough to the Test Standard that it is within the SCAN-LAN VI's measurement uncertainty. As a result, the PASS or FAIL judgment is uncertain, and therefore the SCAN-LAN VI cannot determine with confidence whether the link conforms to the Test Standard.

The following steps may be taken in order to resolve link tests with marginal measured results:

1. Reduce the measurement uncertainty. If you are currently using a Level I-rated Performance Module (PM), replace it with a Level II-rated PM and retest. If the test result is still marginal, or if you are already using a Level II-rated PM, go to the next step.

2. Recheck the link installation, focusing on connection points. Refer to **Chapter 8, Testing Twisted-Pair Cable**, for suggestions on causes for excessive NEXT and attenuation. Correct the installation, if possible, and retest.

6. Cable Test Descriptions

This chapter describes each test, and how to run each test individually. Refer to **Chapter 8, Testing Twisted-Pair Cable**, for detailed test results interpretation and more troubleshooting tips.

While it is usually recommended to use Autotest for most cable testing, individual cable tests may be useful in troubleshooting specific cable problems.

For example, Autotest may reveal a wire-map problem requiring remounting of connectors. It may be faster to use the individual Wire-Map test to verify the correction and then to perform another Autotest sequence for a certification record.

6.1 Wire Map

Wire Map checks twisted-pair cable for pin-to-pin and shield continuity, and it also checks for split pairs.

Although it's one of the tests run during Autotest and Quick Check, it can also be run individually.

Wire Map tests for reversed pair, shorts, opens, crossed pairs, split pairs, miswires, and shield continuity.

6.1.1 RUNNING WIRE MAP

1. Connect one end of the cable under test to the SCAN-LAN VI and the other end to the remote unit. Set the remote unit's dial to REMOTE.

2. Set dial to WIRE MAP. The test begins scanning immediately. (Press the arrow keys to select another cable test standard.)

NOTE
Wire Map runs continuously to enable you to find intermittent wiring problems.

All four pairs will be tested and the results displayed, even if the selected test standard does not require all the pairs to be tested. However, a PASS/FAIL determination is based only on the pairs required by the selected cable-test standard.

6.1.2 VIEWING WIRE MAP RESULTS

The results of the Wire Map test are displayed on the SCAN-LAN VI screen. The following illustrations show possible wiring faults.

Crossed Pair

Split Pair
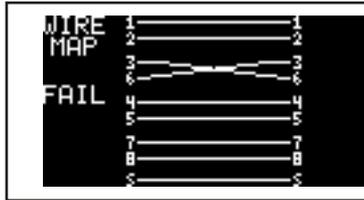
Reversed Pair
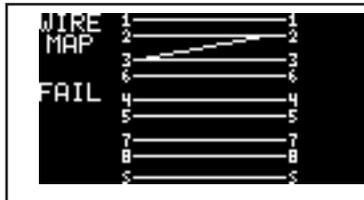
Short

Open

6.2 NEXT

NEXT (Near-End Crosstalk) is a measure of noise coupled between two twisted pairs measured at the same end of the cable as the disturbing signal source. When you test a twisted-pair cable, NEXT is measured using all pair combinations.

NEXT is one of the tests run during Autotest and Quick Check. It is one of the fundamental certification tests for Category 3, 4, and 5 UTP cabling. It can also be run individually as an Extended Functions test.

NEXT tests for excessive crosstalk between pairs and proper pair connections.

6.2.1 RUNNING NEXT

1. Connect one end of the cable under test to the SCAN-LAN VI and the other end to the remote unit. Set the remote unit's dial to REMOTE.

2. Set the dial to EXTENDED FUNCTIONS.

3. Press ENTER (NEXT is the first selection). (Press the arrow keys to change the cable test standard.)

4. Press Start (F1) to restart NEXT.

NOTE
When the NEXT test is performed, both ends are tested.

6.2.2 VIEWING NEXT SUMMARY RESULTS

The NEXT of each pair combination is compared to the selected cable test standard and PASS or FAIL is indicated.

6.2.3 MARGINAL TEST RESULTS

A PASS* or FAIL* result (PASS or FAIL with an asterisk) indicates that a measured NEXT value is close enough to the Test Standard that it is within the SCAN-LAN VI's measurement uncertainty. As a result, the PASS or FAIL judgment is uncertain, and therefore the SCAN-LAN VI cannot determine with confidence whether the link conforms to the Test Standard.

To resolve link tests with marginal measured results:

1. Reduce the measurement uncertainty. If you are currently using a Level I-rated Performance Module, replace it with a Level II-rated Performance Module and retest. If the test result is still marginal, or if you are already using a Level II-rated Performance Module, go to the next step.

2. Recheck the link installation, focusing on connection points. Refer to **Chapter 8, Testing Twisted-Pair Cable**, for suggestions on causes for excessive NEXT. Correct the installation, if possible, and retest.

6.2.4 VIEWING DETAILED NEXT RESULTS

The worst measured crosstalk is shown in the detailed test display. The display indicates the frequency of this measurement, the measured value in decibels (dB), and the test limit.

To view the details of the NEXT test:

1. From the NEXT summary result screen, press DETAIL (F3).

```
REMOTE    NEXT      ↑
12/36     PASS
12/45     PASS
12/78     PASS
36/45     PASS
36/78     PASS
45/78     PASS      ↓
SEND    GRAPH    DETAIL    SAVE
```

F1   F2   F3   F4

2. Press SEND (F1) to send the results to the remote unit.

3. Press SUMMARY (F3) or ESC to return to the summary screen.

6.2.5 VIEWING A GRAPH OF NEXT RESULTS

1. From the detail or Summary Results screen, press GRAPH (F2).

```
20
30              31.3
40
50
60
12/78    41.6dB @ 75.0MHz   100
PAIR    SEND    SUMMARY    PRINT
```

F1   F2   F3   F4
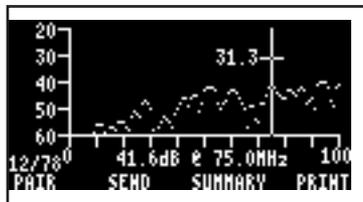
2. Press PAIR (F1) to display the results for a different pair combination. Press SEND (F2) to send the results to the remote unit.

3. Press the arrow keys to move the cursor to a new point on the graph. The test result at the selected point is displayed below the graph.

4. Press PRINT (F4) to send a comma-separated variable (CSV) listing of the results to the serial port. This outputs a complete listing of all NEXT measurements for all pair combinations.

5. Press SUMMARY (F3) or ESC to return to the Summary screen.

NOTE

The test result displayed on the graph is the worst value found within 1-MHz frequency increments for Category 5 and ISO Class D testing. All test results are available and can be output from the SCAN-LAN VI.

6.2.6 CERTIFYING CATEGORY 5 CABLING—PAIR-TO-PAIR NEXT METHOD

NEXT, as defined in TIA TSB-67, is a measure of signal coupling from one pair to another pair within the four-pair cable. It is also sometimes called pair-to-pair NEXT. TSB-67 requires that pair-to-pair NEXT be measured on all six pair combinations, and that the worst pair-to-pair NEXT measurement not exceed specified test limits for the Basic Link or Channel test configurations.
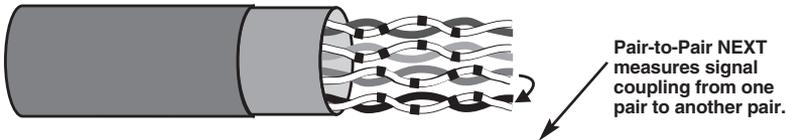
Pair-to-Pair NEXT measures signal coupling from one pair to another pair.

The pair-to-pair NEXT measurements, however, only account for crosstalk coupled from any one pair to another—not the possible total crosstalk that might bc coupled from multiple pairs in the same sheath. The TSB-67 methodology assumes that only two pairs of the cable would be used at any given time for data transmission. While pair-to-pair NEXT is an appropriate crosstalk measure for 2-pair network schemes, such as 10BASE-T and 100-BASE-TX, it does not provide an adequate measure of cable performance when multiple pairs within the same sheath may be transmitting simultaneously.

6.3 Length

The Length test measures the cable length and the distance to a cable fault, such as a short, open, or impedance change.

The Length test locates significant impedance changes or anomalies in a cable segment that may be caused by cable damage or inadequate connections at patch panels, cross-connect blocks, modular plugs, or wall plates.

Length is one of the tests run during Autotest and Quick Check. This test can also be run individually.

The Length test measures length of each pair, locates up to two intermediate impedance anomalies, and measures propagation delay of each pair.

NOTE

The accuracy of a Length measurement is dependent on the proper cable NVP setting. Refer to Chapter 10, Calibration, for the procedure to calibrate cable NVP.

6.3.1 RUNNING LENGTH TEST

1. Connect one end of the cable under test to the SCAN-LAN VI.

2. Set dial to LENGTH. The test begins scanning immediately. (Press the arrow keys to select another cable test standard.)

NOTE

For accurate results, do not use the remote unit when performing a Length measurement test, except during Autotest or Quick Check.

6.3.2 VIEWING LENGTH RESULTS

At the completion of the Length test, the screen displays the summary results.

```
LENGTH  Limit: 328ft
1,2    12ft  OPEN  PASS
3,6    11ft  OPEN  PASS
4,5    10ft  OPEN  PASS
7,8    12ft  OPEN  PASS

START   PDELAY  DETAIL
```

(F1)   (F2)   (F3)   (F4)

1. Press START (F1) to restart the Length test.

2. Press DETAIL (F3) to view more information about the Length test results.

3. Press PDELAY (F2) to view the Propagation Delay for each pair.

NOTES

1. Some variation in the measured length of wire pairs within the same cable is considered normal. This is due to the difference in construction of the individual pairs.

Length variation from pair to pair will be greater for longer cable lengths.

2. An asterisk (*) next to a PASS result indicates that the measured value is close enough to the standard input that it is within the SCAN-LAN VI's measurement uncertainty.

3. When measuring spooled and other uninstalled cables, the cable length will probably be greater than the specification test limit. This will cause a FAIL Length test result. In this case, you may ignore the fail message.

4. A cable found to have a "short" will cause length test to FAIL regardless of measured length.

5. OPEN or SHORT usually indicates that a pair ends in an open or a short. However, if the remote unit is used, an OPEN result should be displayed for each pair.

6. Propagation Delay is the time in nanoseconds for a pulse to travel the length of a twisted pair.

7. For instruction on changing length units (feet/meters), refer to Chapter 9, Setup.

To view more information about the Length test results:

1. Press DETAIL (F3).

```
LENGTH DETAIL
              Anom1 Anom2
1,2    21ns
3,6    22ns    19ns
4,5    22ns
7,8    22ns
START  LENGTH  SUMMARY
```

(F1)   (F2)   (F3)   (F4)

2. Press SUMMARY (F3) or ESC to return to the Length test summary display.

NOTE

Detected impedance changes greater than the Fault Threshold are displayed as anomalies (Anom1 and Anom2). Fault Threshold is pre-set at the factory, but can be modified in the SETUP menu. See Chapter 9, Setup, for Fault Threshold changes.

When the cable length is less than 20 feet, anomalies might not be detected.

6.4 Attenuation

Attenuation measures the reduction in the signal level as it travels over the length of a cable.

Attenuation is measured over a range of frequencies. The amount of attenuation loss is expressed in decibels (dB). A signal is transmitted by the remote unit and received by the main unit (the signal is one-way).

Attenuation is one of the tests run during Autotest and Quick Check. It can also be run individually.

Attenuation detects one-way attenuation of each cable pair, poor connections/terminations, substandard wire, and faulty connectors.

6.4.1 RUNNING ATTENUATION

1. Set the SCAN-LAN VI dial to EXTENDED FUNCTIONS.

2. Press the arrow key to select Attenuation.

3. Press ENTER. The test begins immediately. (Press the arrow keys to select another cable test standard.)

4. Press START (F1) to re-run the test.

6.4.2 VIEWING ATTENUATION RESULTS

To view the test-standard specification values:

1. Press SPEC (F3).

2. Press SEND (F1) to restart the Attenuation test.

6.4.3 VIEWING A GRAPH OF ATTENUATION RESULTS

1. From the test summary screen, press GRAPH (F2) to view the graph of the Attenuation test results.

2. Press PAIR (F1) to display an Attenuation graph for a different pair.

3. Press the arrow keys to move the cursor to another point on the graph.

4. Press SEND (F2) to send the results to the remote unit.

5. Press PRINT (F4) to send a comma-separated variable (CSV) listing of the results to the serial port. This provides a complete listing of all Attenuation measurements for all pairs.

6. Press SUMMARY (F3) or ESC to return to the summary screen.

6.4.4 MARGINAL TEST RESULTS

A PASS* or FAIL* result (PASS or FAIL with an asterisk) indicates that a measured NEXT or attenuation value is close enough to the Test Standard that it is within the measurement uncertainty of the SCAN-LAN VI. As a result, the PASS or FAIL judgment is uncertain, and therefore the SCAN-LAN VI cannot determine with confidence whether the link conforms to the Test Standard.

The following steps may be taken in order to resolve link tests with marginal measured results:

1. Reduce the measurement uncertainty. If you are currently using a Level I-rated Performance Module (PM), replace it with a Level II-rated PM and retest. If the test result is still marginal, or if you are already using a Level II-rated PM, go to the next step.

2. Recheck the link installation, focusing on connection points. Refer to **Chapter 8, Testing Twisted-Pair Cable**, for suggestions on causes for excessive NEXT and attenuation. Correct the installation, if possible, and retest.

6.5 ACR

Attenuation-to-Crosstalk Ratio (ACR) is the difference between crosstalk and attenuation, measured in dB, at a given frequency. ACR is computed based on the measured values of attenuation and NEXT.

A positive ACR is necessary to assure that a signal at the receiving end of a channel is stronger than the crosstalk interference imposed from adjacent wire pairs. ACR is therefore an indication of the expected reliability of data transmissions.

ACR is automatically computed during Autotest and Quick Check when testing twisted-pair cable. It can also be run individually as an Extended Function test.

6.5.1 RUNNING ACR

1. Set the dial to EXTENDED FUNCTIONS.

2. Press the arrow keys to highlight ACR.

3. Press ENTER. The test begins scanning immediately. (Press the arrow keys to select another cable test standard.)

6.5.2 VIEWING ACR RESULTS

For each pair combination the ACR is displayed along with the frequency. The attenuation value used is from the receive pair (for example, pair 3,6 of 12/36).

```
ACR      MHz    dB
12/36    92.7   24.6
12/45    91.1   18.8
12/78    51.7   37.5
36/45    19.0   44.3
36/78    96.5   28.1
45/78    92.2   27.2
START
```

F1   F2   F3   F4

Press START (F1) to restart the test.

NOTE

Minimum ACR is not presently specified in most link test standards (such as TIA TSB-67) or network standards (such as IEEE 802.3). ISO 11801 requires at least 4 dB of ACR at 100 MHz. Hub manufacturers recommend a minimum of 5 dB for reliable data transmission.

6.5.3 LINK PERFORMANCE ANALYSIS BEYOND 100 MHZ—ACR AND HEADROOM

Power Sum ACR measurements beyond 100 MHz are valuable for determining adequate performance of enhanced Category 5 cabling. Current Category 5 standards require a minimum of 10 dB ACR at 100 MHz. Proposed Category 6 standards recommend an ACR value of a minimum 10 dB ACR at 200 MHz.

System 6 provides this measure of cable performance up to 250 MHz. The frequency at which the cable had a measured 10 dB ACR value is clearly displayed in the LINK PERFORMANCE screen. The following graph illustrates the ACR vs. Frequency relationship:
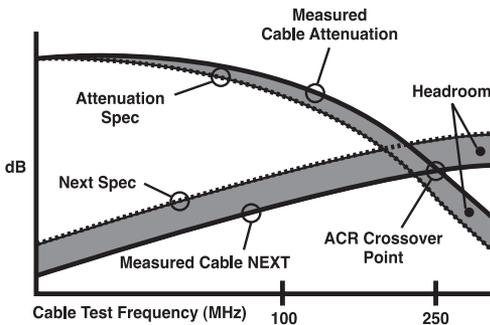
6.6 Noise

Impulse Noise is non-repetitive electrical spikes or pulses caused by external electromagnetic fields. It is one of the primary causes of inconsistent performance on unshielded twisted-pair networks.

The Noise test counts noise impulses (spikes) greater in amplitude than a minimum threshold on an idle twisted-pair cable segment and provides a report of the results.

Noise results for all selected cable types are compared to the IEEE 802.3 10BASE-T impulse noise specification. The default noise-threshold setting is 260 mV. Refer to **Chapter 9, Setup**, for information on how to change this value.

The Noise test reports time duration of the test, average number of impulses in the last second, peak number of impulses in any one second, and the time of occurrence since the start of the test.

6.6.1 RUNNING NOISE

The Noise test runs continuously until stopped by the user.

1. If testing a twisted-pair cable, connect one end of the cable under test to the main unit and the other end to the remote unit. Set the remote unit's dial to REMOTE.

2. Set the main unit's dial to EXTENDED FUNCTIONS. Scroll through the list of functions until NOISE is highlighted.

3. Press ENTER to select the test. The test begins immediately. (Press the arrow keys to change the cable test standard.)

NOTE

The cable should not be connected to an active network during the Noise test, because the test will record network traffic as noise impulses.

6.6.2 VIEWING NOISE RESULTS

The display provides a continuously updated, real-time report illustrated by the following figure:

NOTE

When testing a 10BASE-T cable per the IEEE 802.3 specification, the maximum allowable impulse-noise rate is 0.2 impulses per second with a 260-mV noise threshold.

6.7 Pair Reversal Test

The Pair Reversal Test provides a means to verify the NEXT measurement consistency of the SCAN-LAN VI as recommended by the draft TIA TSB-67 Link Testing Standard. In the Pair Reversal Test, the NEXT of a link is first measured when transmitting on one pair and receiving on another. Then the test is performed again with the transmit and receive pairs reversed. The results should agree within the magnitude of the SCAN-LAN VI's NEXT measurement-accuracy specification. The test is performed automatically on all pair combinations.

RUNNING PAIR REVERSAL

1. Connect one end of the cable under test to the SCAN-LAN VI and the other end to the remote unit. Set the remote unit's dial to REMOTE.

2. Set the dial to EXTENDED FUNCTIONS.

3. Press the arrow keys to highlight PAIR REVERSAL.

4. Press ENTER. Press ESC to abort the test. (Press the arrow keys to select another cable test standard.)

6.8 Repeatability Test

The Repeatability Test confirms that multiple NEXT measurements are essentially the same.

The Repeatability Test provides a means to verify the NEXT measurement consistency of the SCAN-LAN VI as recommended by the draft TIA TSB-67 Link Testing Standard. In the Repeatability Test, NEXT tests are performed twice on the same pair combination and the measured results compared. Differences should be less than the magnitude of the SCAN-LAN VI's NEXT measurement-accuracy specification.

RUNNING REPEATABILITY

1. Connect one end of the cable under test to the SCAN-LAN VI and the other end to the remote unit. Set the remote unit's dial to REMOTE.

2. Set the dial to EXTENDED FUNCTIONS.

3. Press the arrow keys to highlight REPEATABILITY.

4. Press ENTER. Press ESC to abort the test. (Press the arrow keys to select another cable test standard.)

6.9 Impedance

The SCAN-LAN VI does not have impedance.

6.10 Cable Toner

The Cable Toner function injects an audible frequency signal on a cable to enable cable identification by a cable toner probe.

A modulated ~1 KHz signal is injected on pin one (1). Any commercially available Toner Probe can be used to identify the corresponding cable end in a remote wiring location.

RUNNING CABLE TONER

1. Connect one end of the cable under test to the SCAN-LAN VI.

2. Set the dial to EXTENDED FUNCTIONS.

3. Press the arrow keys to highlight CABLE TONER.
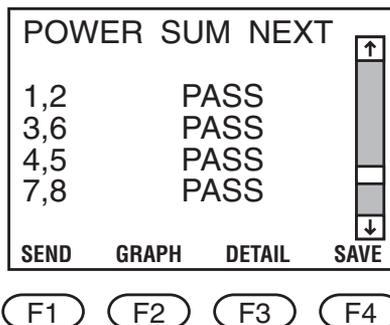
4. Press ENTER. Press ESC to abort the test. (Press the arrow keys to select another cable test standard.)

NOTE

When the AUTO TONER is ON, the toner function is activated whenever a remote is not attached and the main unit is set to Quick Check or Autotest. When a remote is attached, the toner is turned OFF automatically and the test proceeds. This makes it easy to identify which cable is ready to be tested next.

6.11 Delay/Delay Skew

Delay is a measure of the time electrical signals take to propagate from one end of the cable to the other end. The difference in propagation delays from one cable pair to another is called Delay Skew.

The Delay test measures and displays the propagation delay of each wire pair. The Delay Skew test measures and displays the difference in propagation delay from each wire pair to the shortest wire pair.

Both Delay and Delay Skew are becoming important parameters for emerging high-speed LAN standards such as 100BASET4, 622-Mbps ATM, and Gigabit Ethernet.
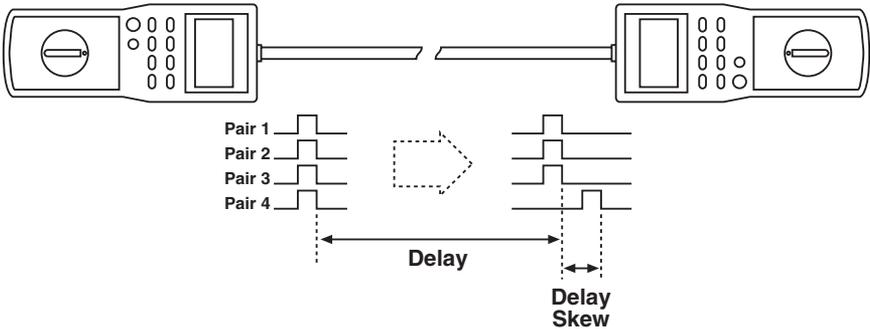
Delay and Delay Skew are tested only during an Autotest or Quick Check. They are included in Autotest for the enhanced cable standards (for example, CAT5 Plus BasicLink). These tests can be added to Autotest or Quick Check for any other cable standard by defining a custom cable standard (see **Appendix A**).

VIEWING DELAY/DELAY SKEW RESULTS

At the conclusion of an Autotest or Quick Check:

1. Press VIEW (F3) to view test results.

2. Press the up or down arrow until Delay test summary screen is displayed.

```
┌─────────────────────────────┐
│ DELAY                    ↑  │
│ 1,2    494ns            ▓   │
│ 3,6    502ns           ▓   │
│ 4,5    489ns           ▓   │
│ 7,8    486ns           ▓   │
│                        ▓   │
│                         ↓  │
│                      SAVE  │
└─────────────────────────────┘
     ( F1 )   ( F2 )   ( F3 )   ( F4 )
```
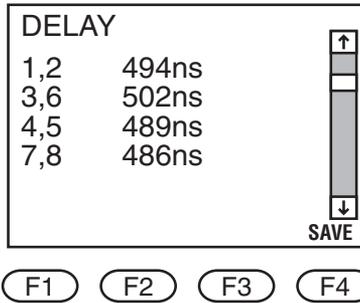
Press the down arrow to view Delay Skew test summary. This screen shows the additional delay time for each pair, compared to the shortest pair.

```
┌─────────────────────────────┐
│ DELAY  SKEW              ↑  │
│ 1,2     8ns            ▓   │
│ 3,6    16ns           ▓   │
│ 4,5     3ns           ▓   │
│ 7,8     0ns           ▓   │
│                       ▓   │
│                         ↓  │
│                      SAVE  │
└─────────────────────────────┘
     ( F1 )   ( F2 )   ( F3 )   ( F4 )
```
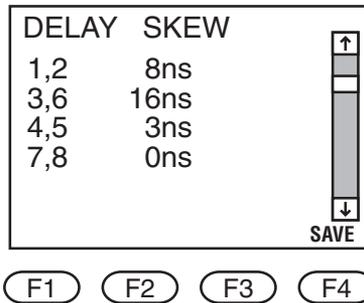
6.12 Resistance

The Resistance test measures and displays in ohms the DC resistance of each wire in the cable.

Resistance is a measure of opposition to DC current flow in a cable. DC resistance can be used to identify poor wire connections, which typically have large resistance. Loop Resistance can be derived by adding the resistance for each wire in the pair.

Resistance can be added to the Autotest suite of tests by defining a Custom Cable standard (see **Appendix A**). Resistance can also be run individually via

EXTENDED FUNCTIONS.

6.12.1 RUNNING RESISTANCE

1. Connect the SCAN-LAN VI to one end of the cable under test.

2. Connect the other end of the cable to the Remote Unit.

3. Set the SCAN-LAN VI's dial to EXTENDED FUNCTIONS. Scroll through the list of functions until RESISTANCE is highlighted.

```
EXTENDED FUNCTIONS
Attenuation          ↑
ACR
Noise
Impedance
Resistance
Cable Toner          ↓
```

  (F1)   (F2)   (F3)   (F4)
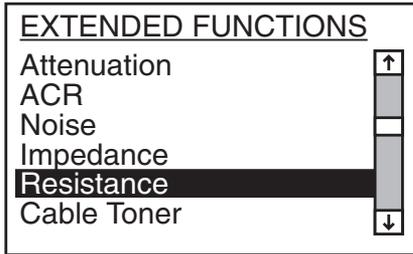
4. Press ENTER to select the test. The test begins immediately. Press ESC to abort the test. (Press the arrow keys to change the cable test standard).

6.12.2 VIEWING RESISTANCE RESULTS

The resistance for each wire in a wire pair is displayed.

```
RESISTANCE
        Wire1  Wire2
1,2     0.0Ω    0.0Ω    PASS
3,6     0.1Ω    0.0Ω    PASS
4,5     0.0Ω    0.1Ω    PASS
7,8     0.0Ω    0.1Ω    PASS

START   SHIELD   SPEC
```

  (F1)   (F2)   (F3)   (F4)

1. Press SPEC (F3) to view the test standard specification value.

2. Press SHIELD (F2) to view the resistance of the cable shield.

3. Press START (F1) to restart the resistance test.

6.13 Power Sum NEXT

NEXT (Near End Crosstalk) is a measure of noise coupled from one pair to another pair in a four-pair cable.

Power Sum NEXT is a sum of the pair-to-pair NEXT coupled from all adjacent pairs. Power Sum is specified by TIA 568A as the recommended method for characterizing NEXT of multipair backbone cable. PS-NEXT can be computed from the individual pair-to-pair NEXT statements.
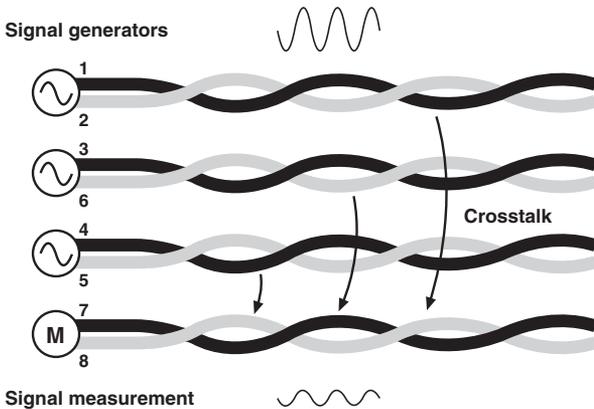
As shown above, Power Sum NEXT is a sum of the pair-to-pair NEXT measurements and is always greater than any pair-to-pair NEXT.

The Power Sum NEXT test uses the same test limit as pair-to-pair NEXT. Since Power Sum NEXT is always greater than pair-to-pair NEXT, the Power Sum NEXT test holds the cable up to a higher standard.

Emerging high-speed networks (for example, 622-Mbps ATM, Gigabit Ethernet) are using several pairs for transmitting data. Power Sum NEXT is an important measure of the crosstalk noise coupled from these transmitters to the receive pair.

Power Sum NEXT is tested only during an Autotest. It is included in Autotest for the enhanced Category 5 and Class D cable test standards (for example, CAT5 Plus BasicLink, ISO Plus Class D).

The graph below shows the computed PS-NEXT for a typical Category 5 link, compared to a composite curve representing the greatest (i.e. closest to the TSB-67 NEXT limit) pair-to-pair NEXT values for the same link. As seen from this example, the PS-NEXT values are always worse than the greatest pair-to-pair NEXT values. In fact, PS-NEXT for four-pair cabling can be as much as 4.77 dB worse than the greatest pair-to-pair NEXT measurement. A link that easily passes TSB-67 Category 5 pair-to-pair NEXT requirements might therefore fail if PS-NEXT is used as the measure.
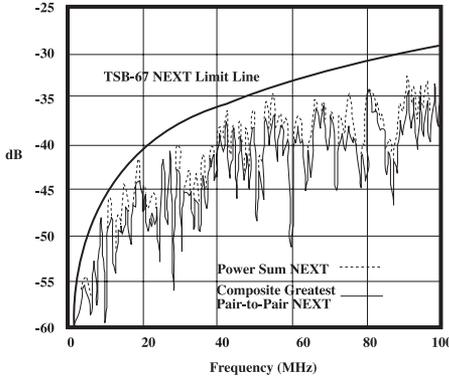
NEXT Limit Line.

Several manufacturers of enhanced-performance CAT 5 cables and connectors specify PS-NEXT as a measure of product performance. Because PS-NEXT is a more stringent NEXT characterization method, components that are specified and tested to meet Power Sum are more likely to deliver optimum performance, even beyond TIA568A defined CAT 5 requirements.

6.13.1 VIEWING POWER SUM NEXT RESULTS

At the conclusion of Autotest, press VIEW (F3) to view the test results and press the arrow keys to display the Power Sum NEXT results.

The Power Sum NEXT of each pair combination is compared to the selected cable test standard and pass or fail is indicated.

```
┌──────────────────────────┐
│ POWER  SUM  NEXT    ┌─┐  │
│                     │↑│  │
│ 1,2         PASS    ├─┤  │
│ 3,6         PASS    │ │  │
│ 4,5         PASS    ├─┤  │
│ 7,8         PASS    │ │  │
│                     ├─┤  │
│                     │↓│  │
│ SEND   GRAPH  DETAIL SAVE│
└──────────────────────────┘
```

$$\boxed{F1} \quad \boxed{F2} \quad \boxed{F3} \quad \boxed{F4}$$
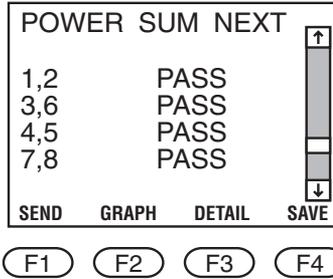
The worst measured crosstalk is shown in the detailed test display. The display indicates the frequency of this measurement, the measured value in decibels (dB) and the test limit.

To view the details of the Power Sum NEXT test:

1. From the Power Sum NEXT summary result screen, press DETAIL (F3).
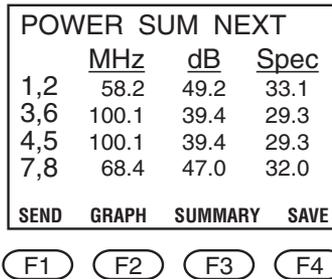
```
┌──────────────────────────┐
│ POWER  SUM  NEXT         │
│        MHz    dB    Spec │
│ 1,2    58.2   49.2   33.1│
│ 3,6   100.1   39.4   29.3│
│ 4,5   100.1   39.4   29.3│
│ 7,8    68.4   47.0   32.0│
│                          │
│ SEND  GRAPH  SUMMARY  SAVE│
└──────────────────────────┘
```

$$\boxed{F1} \quad \boxed{F2} \quad \boxed{F3} \quad \boxed{F4}$$

2. Press SEND (F1) to send the results to the remote unit.

3. Press SUMMARY (F3) or ESC to return to the summary screen.

6.13.2 VIEWING A GRAPH OF POWER SUM NEXT RESULTS

To view a graph of the Power Sum NEXT test results:

1. From the detail or Summary Results screen, press GRAPH (F2).
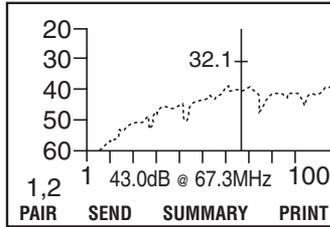
2. Press PAIR (F1) to display the results for a different wire pair. Press SEND (F2) to send the results to the remote unit.

3. Press the arrow keys to move the cursor to a new point on the graph. The test result at the selected point is displayed below the graph.

4. Press Print (F4) to send a comma-separated variable (CSV) listing of the results to the serial port. This outputs a complete listing of all Power Sum NEXT measurements for all pairs.

5. Press SUMMARY (F3) or ESC to return to the Summary screen.

NOTE

The test result displayed on the graph is the worst value found within 1-MHz frequency increments for Category 5 and ISO Class D testing. All test results are available and can be output from the SCAN-LAN VI.

6.14 Cable Grading

The SCAN-LAN VI does not perform cable grading.

7. Printing, Uploading, and Viewing Test Results

The Print function allows you to send test results to a serial printer, upload the test results to a PC, or view stored test reports before printing or uploading.

The Print function allows you to: Print some or all of the saved reports, print the last Traffic Report, delete saved reports, and view saved reports.

7.1 Connecting to a PC or Printer

7.1.1 OVERVIEW

Connect the single, 9-pin connector end of the PC Interface Cable to the serial port on the SCAN-LAN VI. Connect one of the connectors on the other end (use either the 9- or the 25-pin connector) to a printer or PC.

NOTE

Make sure you do not leave the unit connected to the PC while making measurements. Doing so may cause a Wire Map Fail error to occur.

7.1.2 ADAPTER/CONNECTOR INFORMATION

The PC Interface Cable (supplied) may not be the correct connector to properly connect to all serial printers. Use only straight-through adapters to connect the PC Interface Cable to a printer.

Connectors with different pin assignments than those mentioned above may affect output operation (see **Chapter 1, Specifications,** for the Serial Port pin assignments).

7.2 Printing/Uploading Test Results

7.2.1 PRINTING/UPLOADING A SINGLE TEST REPORT

1. Set dial to PRINT to display the Print menu.

2. Press the arrow keys to highlight the test report you wish to print or upload.

3. Press PRINT (F4) or ENTER.

4. Follow the procedure in **Section 7.2.5**.

7.2.2 PRINTING/UPLOADING MULTIPLE REPORTS

1. Set dial to PRINT to display the Print menu.

2. Press the arrow keys to highlight a test report you wish to print or upload.

3. Press SELECT (F1) to place a check mark next to the report number.
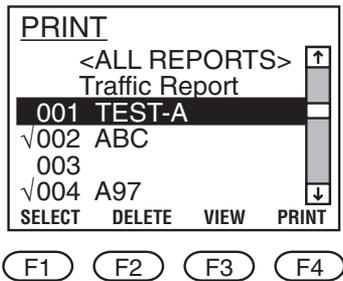
4. Repeat steps 2 and 3 to select all reports to be printed/uploaded.

5. Press PRINT (F4) or ENTER.

6. Follow the procedure in **Section 7.2.5**.

NOTE

Reports can also be de-selected by highlighting a selected report and pressing DESELECT (F1).

7.2.3 PRINTING/UPLOADING ALL REPORTS

1. Set dial to PRINT to display the Print menu.

2. With <ALL REPORTS> highlighted, press SELECT (F1) or ENTER.

3. Press PRINT (F4) or ENTER.

4. Follow the procedure in **Section 7.2.5**.

NOTE

Any selected test reports can be deselected by highlighting the report number and pressing DESELECT (F1), prior to PRINT.

7.2.4 UPLOADING DETAILED NEXT/ATTENUATION RESULTS

Detailed NEXT or Attenuation test results can only be output to a PC immediately following completion of the test.

To upload detailed NEXT or Attenuation test results:

1. Complete the Autotest, individual NEXT, or individual Attenuation test.

2. Select GRAPH (F2) screen from the summary screen.

3. Press PRINT (F4).

NOTE

Detailed NEXT and Attenuation test results can only be uploaded to a PC in Comma Separated Variable (CSV) format. Serial-port settings (baud rate and flow control) are determined by SETUP parameters. See Chapter 9, Setup.

7.2.5 CHANGING SERIAL-PORT SETTINGS

You can change the serial-port settings for these selections: baud rate, flow control, and output-report format.

The serial-data format is fixed at 8-bit, no parity, 1 stop bit (8N1).

1. Press BAUD (F1) to increment from 1200 to 38,400 baud.

2. Press FLOW (F2) to select flow control:

    a. XON/XOFF (software)

    b. HARDWARE (CTS/DTR)

    c. NONE (for no flow control).

3. Press FORMAT (F3) to select the output format and choose from the following:

    a. TEXT (F3) for a pre-formatted report ready for printing.

    b. COMMA (F3) for comma-separated variables (CSV) suitable for uploading to a computer and importing to a database or spreadsheet.

4. Press PRINT (F4) to begin print/upload.

5. To abort a report print out, press ESC.

NOTE

Serial-port setting changes are automatically stored in nonvolatile memory.

7.2.6 SAMPLE 250 MHZ UTP AUTOTEST REPORT

Up to 450 test reports can be saved in each SCAN-LAN System 6 tester. Reports can be uploaded to a PC and viewed or printed with the Report Manager software.

Sample 250 MHz UTP Autotest Report

CABLE CERTIFICATION REPORT #1

Circuit ID: Local Module Type: C6 Modular Plug
Cable Test Standard: 250 MHz UTP   Remote Module Type: C6 Modular Plug
Location: BUILDING D, FLOOR 6   Serial Number: 98XXXXX V8.80D4
Date Tested: 05/01/1998   Cable NVP: 72.0%

TEST SUMMARY: PASS

───

Wire Map: PASS Near End	1	2	3	4	5	6	7	8 Sld
	|	|	|	|	|	|	|	|
Remote End	1	2	3	4	5	6	7	8

───

Length: PASS   Limit: 308 ft.

Pair	Length	Delay	Delay Skew	Comments
1.2	85 ft.	116 ns	0 ns	OPEN
3.6	86 ft.	118 ns	2 ns	OPEN
4.5	85 ft.	118 ns	2 ns	OPEN
7.8	86 ft.	120 ns	4 ns	OPEN

───

Attenuation:	PASS	1.2	3.6	4.5	7.8
Attenuation	dB	PASS	PASS	PASS	PASS
Limit	dB	6.0	6.0	6.0	6.0
Margin	dB	+15.6	+15.4	+15.4	+15.5
Frequency	MHz	101.0	101.0	101.0	101.0

───

PSNEXT:	PASS	1.2	3.6	4.5	7.8
		PASS	PASS	PASS	PASS
Power Sum	dB	38.3	36.4	35.6	42.6
Limit	dB	31.2	31.2	29.3	33.7
Margin	dB	+7.1	+5.2	+6.3	+8.9
Frequency	MHz	76.5	76.5	100.1	54.0
PSACR	dB	33.4	31.4	29.6	38.5
REMOTE PSNEXT: PASS	1.2	3.6	4.5	7.8	
		PASS	PASS	PASS	PASS
Power Sum	dB	35.7	34.5	33.5	45.2
Limit	dB	29.3	30.0	29.3	35.7
Margin	dB	+6.4	+4.5	+4.2	+9.5
Frequency	MHz	100.1	91.1	100.1	40.5
PSACR	dB	29.9	28.8	27.7	41.8

───

Link Performance		1.2	3.6	4.5	7.8
Headroom	dB	7.3	5.2	6.3	9.8
PSACR Xover	MHz	>250	>250	>250	>250
PSACR 10 dB	MHz	>250	232	244	>250

Rem Link Performance		1.2	3.6	4.5	7.8
Headroom	dB	6.4	4.5	4.2	11.1
PSACR Xover	MHz	>250	>250	>250	>250
PSACR 10 dB	MHz	>250	214	227	>250

───

<<NOTE: *Pass/Fail uncertain. Result within measurement uncertainty.>>
Operator:_____   Date:_____
Comments: END REPORT #DR-01

7.3 Deleting Test Reports

Reports may be deleted from memory by performing these steps:

1. Set the dial to PRINT to display the Print menu screen.

2. Press the arrow keys to highlight the test report you wish to delete.

3. Press SELECT (F1) to select specific reports to be deleted. A check mark
   appears next to the report number.

NOTE

**To select all reports for deletion, press SELECT (F1) when <ALL
REPORTS> is highlighted. This selects all of the report numbers.**

4. Press DELETE (F2). A screen displays the selected report numbers and
   asks you to confirm that you wish to delete the tests. (If no reports were
   selected, the highlighted report is selected for deletion.)

5. Press OK (F4) or ENTER to delete the report. After the report is deleted,
   the unit returns to the Print screen.

   or

   To cancel the DELETE, press CANCEL (F1) or ESC and return to the
   Print screen.

7.4 Viewing Saved Test Reports

To review a saved report:

1. Set dial to PRINT to display the Print menu screen.

2. Press the arrow keys to highlight the number of the test report
   you wish to view.

3. Press VIEW (F3) to view the report.

4. Press the arrow keys to view different test results.

5. Press ESC to return to the Print menu screen.

NOTE

**Refer to Chapter 6, Cable Test Descriptions, for more information on
interpreting test result screens.**

SCAN-LAN Vt NETWORK TRAFFIC REPORT

Start Time: 15:29:14   Date: 08/08/1995   Operator:
Cable Test Standard: 10Base-T   Module Type: Modular Plug
Location: _____   Serial Number: 0000000

***Average Utilization   ---Peak Utilization   C = % Collisions

```
                        Percent Network Utilization
Time    0    5   10   15   20   25   30   35   40   45   50   75  100      Packet
HH:MM:SS +------+------+------+------+------+------+------+------+------+------+------+------+      Rate
00:00:10 ***-------                                                               336
00:00:11 ***                                                                      345
00:00:12 **                                                           NO LINK     153
00:00:13                                                              NO LINK       0
00:00:14                                                              NO LINK       0
00:00:15                                                              NO LINK       0
00:00:16                                                              NO LINK       0
00:00:17                                                              NO LINK       0
00:00:18                                                              NO LINK       0
00:00:19 *                                                            NO LINK      66
00:00:20 ***                                                                      260
00:00:21 ***                                                                      225
00:00:22 ***                                                                      321
00:00:23 ***                                                                      299
00:00:24 ***                                                                      270
00:00:25 ***                                                                      325
00:00:26 ***                                                                      272
00:00:27 ***                                                                      285
00:00:28 ***                                                                      299
00:00:29 ***                                                                      310
00:00:30 ***                                                                      297
00:00:31 ***                                                                      273
00:00:32 ***                                                                      341
00:00:33 ****                                                                     400
00:00:34 *C**                                                                     372
00:00:35 ****                                                                     472
00:00:36 ********                                                                1070
00:00:37 *C******                                                                1192
00:00:38 *******                                                                 1027
00:00:39 ******                                                                   924
00:00:40 ******                                                                   963
00:00:41 ******                                                                   897
00:00:42 ******                                                                   924
00:00:43 ******                                                                   980
00:00:44 ******                                                                   962
00:00:45 ******                                                                   984
00:00:46 ******                                                                   961
00:00:47 *****                                                                    664
```

Figure 7-1. Sample Autotest Text Report.

SCAN-LAN Vt NETWORK TRAFFIC REPORT

Start Time: 15:29:14   Date: 08/08/1995   Operator:
Cable Test Standard: 10Base-T   Module Type: Modular Plug
Location: _____   Serial Number: 0000000

***Average Utilization   ---Peak Utilization   C = % Collisions

Percent Network Utilization

Time	0	5	10	15	20	25	30	35	40	45	50	75	100	Packet
HH:MM:SS	+------+------+------+------+------+------+------+------+------+------+------+------+											Rate
00:00:10 ***-------													336
00:00:11 ***													345
00:00:12 **											NO LINK		153
00:00:13											NO LINK		0
00:00:14											NO LINK		0
00:00:15											NO LINK		0
00:00:16											NO LINK		0
00:00:17											NO LINK		0
00:00:18											NO LINK		0
00:00:19 *											NO LINK		66
00:00:20 ***													260
00:00:21 ***													225
00:00:22 ***													321
00:00:23 ***													299
00:00:24 ***													270
00:00:25 ***													325
00:00:26 ***													272
00:00:27 ***													285
00:00:28 ***													299
00:00:29 ***													310
00:00:30 ***													297
00:00:31 ***													273
00:00:32 ***													341
00:00:33 ****													400
00:00:34 *C**													372
00:00:35 ****													472
00:00:36 ********													1070
00:00:37 *C******													1192
00:00:38 *******													1027
00:00:39 ******													924
00:00:40 ******													963
00:00:41 ******													897
00:00:42 ******													924
00:00:43 ******													980
00:00:44 ******													962
00:00:45 ******													984
00:00:46 ******													961
00:00:47 *****													664

Figure 7-2. Sample Traffic Text Report.

8. Testing Twisted-Pair Cable

This chapter contains information about the fundamentals of testing twisted-pair cables. It also discusses common wiring problems and reasons that cables fail. Tables of troubleshooting tips are provided throughout the chapter; use them for quick reference when troubleshooting a cable segment.

8.1 Types of Twisted-Pair Cable

Twisted-pair cable is so called because of the physical make-up of the cable. Two wires are physically twisted together along the length of the cable to form a pair.

There are three basic kinds of twisted-pair cable: Unshielded Twisted Pair (UTP), Shielded Twisted Pair (STP), and Screened Twisted Pair (ScTP). Figure 8-1 illustrates the differences in the construction of twisted-pair cables.

Unshielded Twisted Pair (UTP)   Shielded Twisted Pair (STP)

drain

Screened Twisted Pair (ScTP)
or Foil Twisted Pair (FTP)
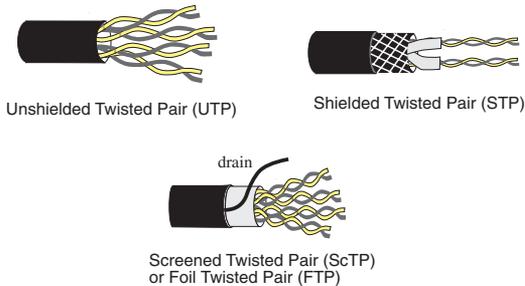
Figure 8-1. Twisted-Pair Cable Construction.

Although UTP is one of the most popular cable test standards to install, it is also highly susceptible to a variety of failures if the cable is not properly installed. The SCAN-LAN VI checks for these possible failures. The test or tests you choose to run depend on whether you are performing a complete check of cable characteristics compared to a standard (cable certification) or troubleshooting a specific cable problem. See **Appendix A, Test Standards**, for an explanation of various test standards.

The TSB-67 UTP Link Performance specification is becoming the benchmark for installed UTP links and is the specification that the SCAN-LAN VI design is primarily based on.

8.2 Twisted-Pair Test Descriptions

The following test descriptions apply to testing four pair Unshielded Twisted Pair (UTP). However, the fundamental concepts can be applied to testing Shielded Twisted Pair (STP) and Screened Twisted Pair (ScTP) cable.

8.2.1 WIRE MAP

Wire map is used to test the continuity of a cable and also to check for split pairs. Continuity is the electrical connection of a wire from one end of the cable to the other.

Typically when testing twisted-pair cable, it's best to have all wires connected straight-through. Straight-through means that pin 1 of the connector on one end is connected to pin 1 of the connector on the other end, pin 2 is connected to pin 2, 3 to 3, and so on.

Figure 8-2 illustrates correct connectivity and pairing per the TIA-568 specification.
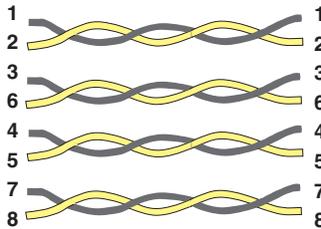
Figure 8-2. TIA-568 Connectivity Requirements.

Wire Map checks for shorts, opens, crossed pairs, reversed pairs, and other wiring errors. Wire Map also checks the continuity of a shield if one exists.

When installing a new link or modifying an old link, it is very common to accidentally create wiring errors. Figure 8-3 illustrates common continuity wiring errors.
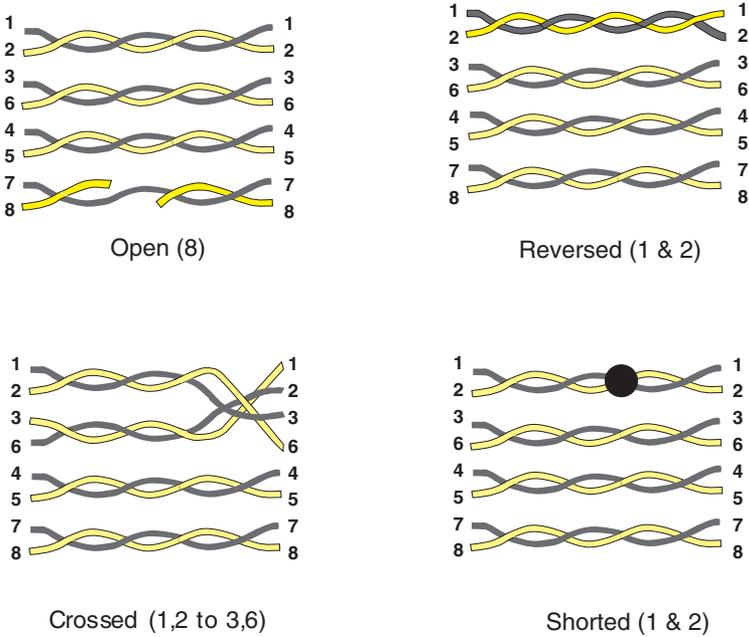
Figure 8-3. Continuity Wiring Errors.

In addition to continuity, the TIA-568 also specifies which pins are associated with specific wire pairs in the cable. When pin-to-pin continuity is maintained, but the proper pairs are not, the wiring error is called a Split Pair. A Split Pair causes severe Near-End Crosstalk (NEXT).

Figure 8-4 illustrates an example of a split pair where pins 1 and 2 are split with 3 and 6.

Refer to the **Section 8.2.2** for an explanation of NEXT.

1,2 splits 3,6
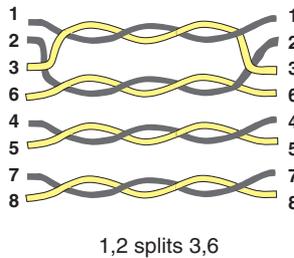
Figure 8-4. Split Pair.

NOTE

A split pair cannot be detected with a simple DC continuity check.

Most wiring problems can be found at the termination points. A chart of common wire map problems and suggested solutions is shown below.

Test Results   **Possible Solutions**

Crossed Pair   Depending on what the cable is being used for, this may be okay. A crossed-pair cable is common for a 10BASE-T application when connecting two hubs.

Double-check the desired specifications for that segment and re-terminate the segment to correct the wiring if necessary.

If the problem continues, follow the possible solutions for

"*OPEN*

on one or more of the pairs" on the next page.

Test Results	**Possible Solutions**
OPEN on one or more of the pairs	Perform a length test to locate fault. Go to the fault and correct the wiring error.
	If you cannot locate the fault by the length test, check all terminations at punchdown blocks, patch panels, and wall plates.
	If no miswires are found, back up to the next-closest telecommunication outlet or transition point and test from there. Continue to the next outlet or transition point until fault the is isolated. Then reterminate the segment.
	If the problem continues, it could be a damaged cable.
SHORT on one or more of the pairs	Follow same procedure as for "*OPEN on one or more of the pairs.*"
Remote unit not connected	Be sure that the main and remote units are connected to the same cable.
	If the connections are correct, follow same procedure as searching for "*OPEN on one or more of the pairs.*"
Reversed pair	Depending on the application, this may be okay.
	Double-check the specification you are testing to and re-terminate the segment if necessary to correct the problem.
	If the problem continues, follow the procedure for "*OPEN on one or more of the pairs*" to locate fault.
Split pair	Make note of which pairs are split. Double-check the requirements (which conductors should be paired) for the segment under test.

Test Results   **Possible Solutions**

Split pair
(continued)

The SCAN-LAN VI is designed to test for EIA/TIA 568
pairing (1,2; 3,6; 4,5; 7,8). USOC pairing is 1,8; 2,7; 3,6; 4,5.
If testing a USOC cable, you will get a split pair between pins
1,2 and 7,8.

Another common pairing is 1,2; 3,4; 5,6; 7,8. If testing this
type, you will get a split pair message between 3,6 and 4,5.

If a split pair is not expected, make sure the cable is twisted pair.
Using silver-satin untwisted cable will also result in split pairs.

Check the coloring of the wiring at all termination points for
proper pairing. Correct the wiring as necessary.
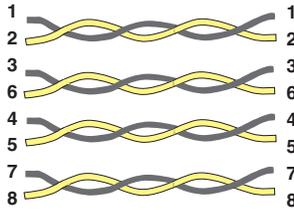
EIA/TIA 568
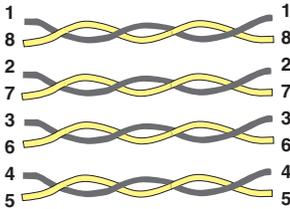
4-pair cable with USOC pairing   Other common pairing
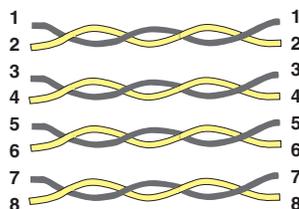
Figure 8-5. Common Wiring Configurations.

8.2.2 NEAR-END CROSSTALK (NEXT)

When a signal is transmitted onto one of the pairs, an electromagnetic field is created around the wires that couples the transmitted signal into adjacent pairs. This coupled signal is referred to as Crosstalk. Crosstalk is similar to the problem that occurs in a telephone when you hear another conversation on your line.

If crosstalk is severe enough, the transmitted signal can interfere with the received signal on another wire pair (see Figure 8-6).
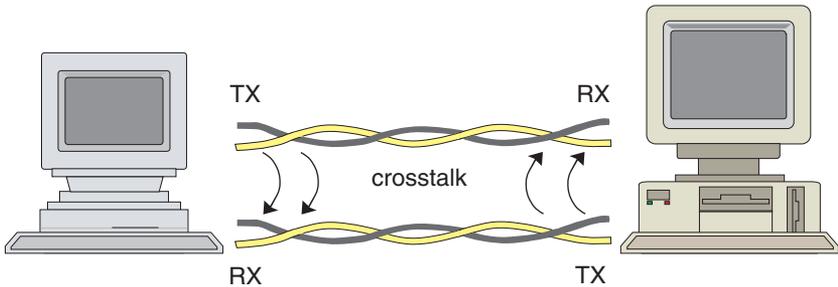
Figure 8-6. Crosstalk Between Stations.

Because crosstalk is measured at the same end of the cable as the signal source, the term Near-End Crosstalk (NEXT) is used to describe this measurement (refer to Figure 8-7).
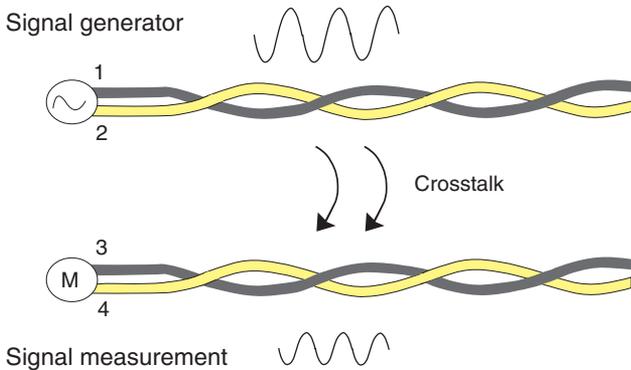
Figure 8-7. NEXT Measurement.

The twisting of pairs of wires is essential to minimizing crosstalk effects from pair to pair. The amount of twisting is a key difference between high-performance Category 5 cable and lesser-rated cable, such as Category 3.

A common problem with installing Category 5 cable is maintaining the wire twist when terminating the cable. The EIA/TIA 568-A specification states the twists must be maintained to within 0.5 inch (1.27 cm) of the termination for Category 5 and within 1 inch (2.5 cm) for Category 4. If the twists are not maintained, NEXT will increase.

NEXT also varies with the frequency of the signal, but the relationship is not linear. Therefore, because the NEXT of a cable is within a certain specification at lower frequencies does not guarantee the NEXT will be within the same specifications at a higher frequency. Figure 8-8 illustrates an example of how NEXT varies with signal frequency.
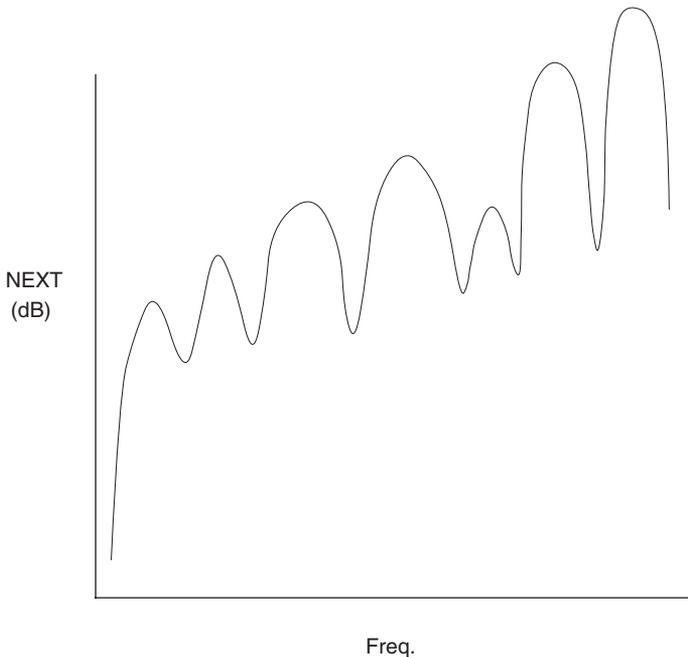
Figure 8-8. Typical Relationship of NEXT and Frequency.

NEXT is measured in decibels (dB). A high dB value, which is typically referred to as low NEXT, is good (for example, 48 dB). This means there is a large difference between the transmitted signal and the resulting NEXT. A low dB value, which is typically referred to as high NEXT, is bad (for example, 20 dB). This means NEXT is significant in relation to the transmitted signal.

The table on the next page describes some common causes of NEXT and their solutions.

Common Causes of Excessive NEXT	Solution
Bad or low-grade patch cables	Patch cables may not be twisted pair. A common mistake is to use silver-satin untwisted cable for data applications.
	Patch cable could be wired incorrectly. Check twisted pairs per the EIA/TIA 568 pairing.
	Check patch cable and rewire or replace as necessary.
Terminating points	NEXT problems are most common at the termination points. Untwisting of the wires too far from the termination is very common. Follow the procedure for "*NEXT test fails one or more pairs*" to troubleshoot.
Split pairs	Because of different standards, there are different pair combinations (for example, USOC, EIA/TIA, etc.). Double-check requirements and rewire if necessary. For troubleshooting, follow procedure for "*Split Pair*" in **Section 8.2.1**.
Use of substandard components (termination components, cable)	It is common to make the mistake of using couplers or lower-grade hardware or cable than the minimum expected. The highest category your installation will comply to is that of the lowest-category component you have in your segment.

The following troubleshooting table describes some common NEXT problems and some solutions.

Test Results	Possible Solutions
NEXT test fails for one or more pairs	Compare test results to actual expected values to confirm misconformance.
	Start at tester end and check that all cable is minimum required grade.
	Check termination hardware to make sure all hardware is at least the minimum grade expected. For example, if testing for Category 3, you could use Category 3, 4, or 5 components. If testing to Category 5, you can only use Category 5 components.
	Check that termination points meet installation standards. Reference the specification you are using. Re-terminate all connections as necessary.
	Run Wire Map to check for split pairs. Follow procedure for "*Split Pair*" in Wire Map section.

Test Results	Possible Solutions
NEXT test fails in one direction but not in the other	Check the terminations closest to where the faulty readings were detected. Follow procedure for "*NEXT test fails for one or more pairs*" to locate fault.
NEXT test indicates a split pair	Follow procedure for "*Split Pair*" in WIRE MAP section.
NEXT test fails intermittently	Check actual results against expected results. Values may be borderline. Simply reterminating a connection could correct the problem. Follow procedure for "*NEXT test fails for one or more pairs*" to locate fault.
NEXT passes on segment from hub to work-area wall plate, but the work-station has problems when connected with its patch cord	Patch cable may not be a twisted-pair cable. A common mistake is to use untwisted telephone wire for data applications. Patch cable could be wired incorrectly. Check twisted pairs per the EIA/TIA pairing. Check patch cable and rewire or replace as necessary. Two pairs of the cable may be in use for data and the other two pairs may be in use for voice.

8.2.3 ATTENUATION

The Attenuation test measures the reduction in the strength or amplitude of a signal as it travels over the length of a twisted-pair cable. The amount of this loss is expressed in decibels (dB) (refer to Figure 8-9).

(Sending unit)   (Receiving unit)
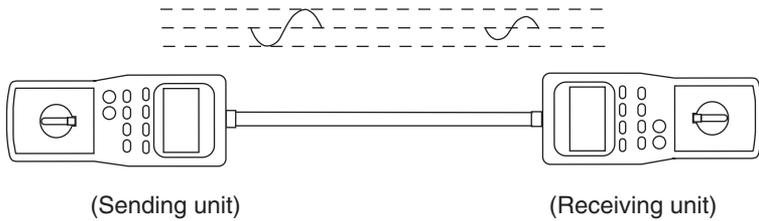
Figure 8-9. Attenuation.

Attenuation varies with frequency and length. Typically, attenuation increases with higher frequencies and longer cables.

The table below lists some common causes of attenuation and possible solutions.

Common Causes of Attenuation	Solutions
Incorrect grade cable for application	Be sure to use the correct grade of cable for the specification being tested. Lower-grade cable can cause greater attenuation.
Patch cables	Patch cables may not be twisted pair. A common mistake is to use untwisted telephone wire for data applications. Make sure patch cable is data grade.
Excessive Length	If specification is based on a maximum length, check length and correct if necessary.
Poor termination	Check all terminations for proper connections. Follow troubleshooting tips in "*Common Problems for Attenuation.*"

Common Causes of Attenuation	Solutions
Impedance Anomalies	A splice in the segment, or damage to a segment, can cause excess attenuation.
	Perform a length test to check for anomalies in the segment.
	If anomaly is detected, go to that point and examine the cable and connections for kinks, cuts, splices, incorrect cable, sharp bends, etc. Repair as necessary.
Substandard components	It is common to make the mistake of using couplers or lower-grade hardware or cable than the minimum expected. The highest category your installation will comply to is that of the lowest-category component in your segment.

The chart below describes some attenuation problems and their possible solutions.

Test Results	Possible Solutions
Attenuation test fails for one or more pairs	Compare actual to expected values to confirm misconformance.
	Check that the length is within specification in applications where attenuation is a maximum limit only. If the cable is too long, correct as necessary.
	If attenuation is based on a per-foot limit, follow the procedure for "*NEXT test fails one or more pairs*" to locate the attenuation problem.
Attenuation test fails intermittently	Compare actual results to expected results. Values may be borderline.
	Re-terminating a connection could correct the problem.
	Follow the procedure for "*NEXT test fails for one or more pairs*" to locate the fault.

8.2.4 LENGTH

The SCAN-LAN VI uses a method called Time Domain Reflectometry (TDR) to measure cable length. With TDR, a signal is transmitted at one end of a cable and, at the same time, a timer is started. The electrical signal travels down the cable until it reaches a change in impedance (for example, an open, a short, a fault in the cable, or a cable mismatch) and part or all of the signal is reflected back. If the cable is properly terminated (that is, the terminator is equal to the impedance of the cable), there will be no reflection of the signal and you will not be able to determine the length. Figure 8-10 illustrates the behavior of the electrical signal when it reaches the end of the cable.

Cable

Transmitted pulse ⟶

open

Reflected pulse

Transmitted pulse ⟶

short

Reflected pulse

Transmitted pulse ⟶

terminator (matches cable characteristic impedance)

No reflected pulse
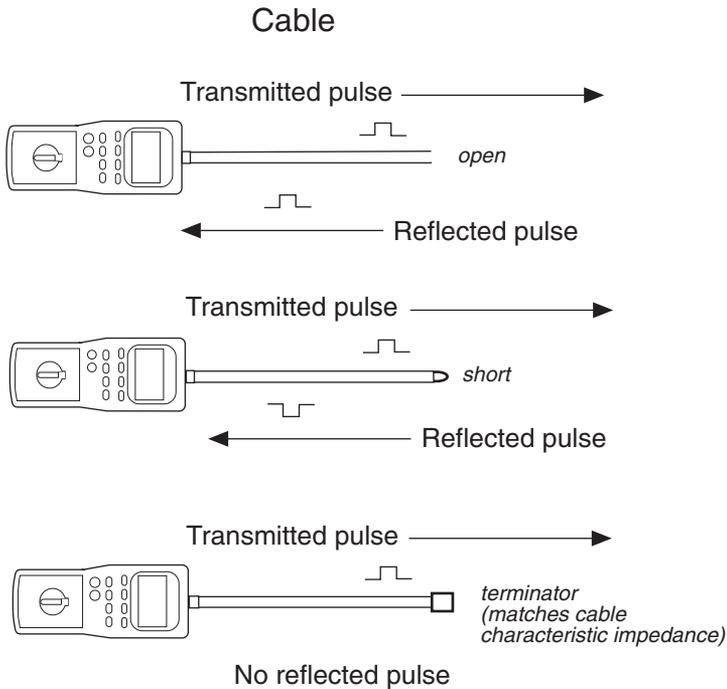
Figure 8-10. Using TDR to Locate Cable Faults.

When the reflected signal reaches the tester where the signal was generated, the timer stops. By knowing the speed of the signal traveling down the cable, you can determine the length of the cable.

How do you know how fast the signal travels down the cable? All cables have an inherent characteristic called Nominal Velocity of Propagation (NVP). This value can be determined by contacting the cable manufacturer. NVP is the speed of signal propagation through a cable, expressed as a percentage of the speed of light in a vacuum (refer to Figure 8-11). Using the NVP value and the time to receive the returned TDR pulse, the SCAN-LAN VI calculates the cable length.

speed of light $= 300,000,000$ m/s

speed of a signal in a cable $= 300,000,000 * \text{NVP}$ m/s

$$\text{NVP} = \frac{\text{speed of a signal in a cable}}{\text{speed of light}} \times 100\%$$
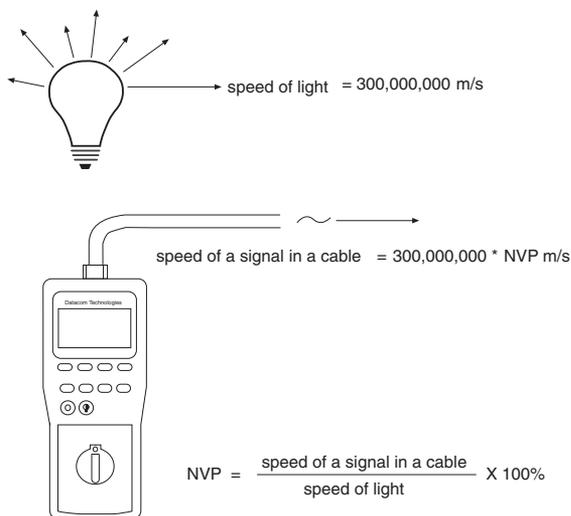
Figure 8-11. Cable Nominal Velocity of Propagation.

To obtain the most accurate Length measurement possible, you must calibrate your test equipment to the cable you are testing. Follow the procedure described in **Chapter 10, Calibration**.

NOTE

It is normal for some variation in the measured length of wire pairs within the same cable. This is due to the difference in construction of the individual pairs. Length variation from pair to pair will be greater for longer cable lengths. Significant differences (more than a few percent) may indicate a fault in a pair.

The actual length of a pair is longer than the length of the cable but the NVP is calibrated to give the length of the cable.

A default threshold value of 7% was chosen for the SCAN-LAN VI. This value corresponds to the worst-case allowable impedance discontinuity specified in IEEE 802.3 for coaxial cable. See **Chapter 9, Setup**, for information on how to change the default threshold value. If you do not want to see anomalies in your test results, increase the fault threshold value.

The SCAN-LAN VI also detects impedance anomalies as part of the Length test. An anomaly is an impedance mismatch along the cable; however, an open or a short is considered the end of the cable, not an anomaly.

An anomaly can be caused by a number of conditions, including a cable mismatch, a cut in the cable, a defect in the cable, a kink in the cable, or a poor connection. When the SCAN-LAN VI sends out a TDR pulse, the severity of the change of impedance determines how much of the signal is reflected back. The Fault Threshold setting in the SCAN-LAN VI determines the minimum reflected signal that will be detected as an anomaly.

Typically, twisted-pair specifications do not address impedance anomalies. This is primarily because when an application uses twisted pair, there is a separate transmit pair and receive pair.

Anomalies are more important to consider when the same wire is used for both transmit and receive (for example, coax cable).

The table on the next page describes some common length problems and solutions.

Test Results	**Possible Solutions**
Anomaly	Check distance to anomaly. Go to distance indicated and check for obvious problem (for example, splice in cable, couplers, kink or bend in cable, bad connection).
	Re-terminate the segment to eliminate the problem. If the problem continues, make sure other parameters, such as attenuation, are within limits. If they are, check the specification you are testing to. If nothing is mentioned in the specification regarding anomalies and all other parameters are within specification, the segment should be fine.
	The anomaly threshold was chosen to aid you in cable troubleshooting. If you do not want to view the anomalies, increase the threshold settings (refer to **Chapter 9, Setup**).
The length measurement is not accurate	Check that the NVP is correct.
	For the most accurate measurement, you must calibrate the unit with a sample of the cable.
SCAN-LAN VI will not display a length measurement	Make sure cable is connected to SCAN-LAN VI. Disconnect the remote unit or any other equipment from the far end of the cable.
	If the cable is less than five feet, the SCAN-LAN VI displays "Cable < 5 feet."
	If the cable is longer than 2,000 feet, the SCAN-LAN VI indicates the cable is too long to measure.

Test Results	Possible Solutions
The length test reveals OPEN	If the remote unit is connected during the length test, the remote creates an OPEN in order to measure the length.
	If the cable was terminated during the test, the SCAN-LAN VI could not measure length.
	If you are concerned about continuity, perform a Wire Map test.
Length exceeds the specification	Compare measured values with expected values.
	Make sure the NVP is correct by calibrating the unit to the cable.
	Adjust the length of the cable as necessary.
Length is double what it should be	Check the termination of the cable.
	If the cable is not connected to the remote unit, the termination hardware may automatically loop back pins (IBM Type A connectors work this way, for example). Thus, the length is twice the distance of the cable.
Length says <5 feet when the cable is longer	Perform a Wire Map test on the segment.
	If Wire Map shows all pairs are OPEN or SHORT, the SCAN-LAN Vt cannot detect the remote unit. Thus, all pairs are OPEN or SHORT within 5 ft. of the SCAN-LAN VI.
	If Wire Map results report that all wires are straight-through, re-run the Length test.
Measured lengths of wire pairs in the same cable are different	Some variation (plus or minus a few percent) is normal because of the way wire pairs are twisted together in a UTP cable.

8.2.5 NOISE

Noise is defined as unwanted signals on the segment. Because of the construction of UTP cable, it acts as an antenna to electromagnetic and radio-frequency signals (refer to Figure 8-12). Examples of noise producers are fluorescent lights, electric motors, power lines, signals caused by voice lines sharing the same pathway as a data line, elevators, and industrial-type equipment.
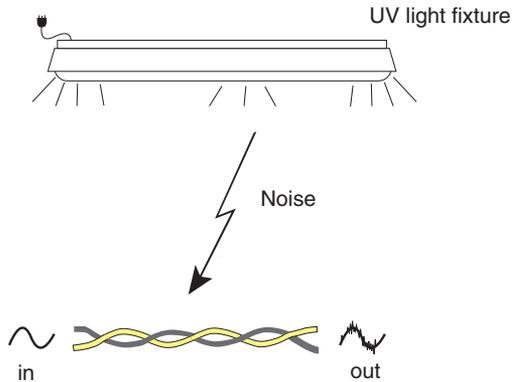
Figure 8-12. Noise.

The IEEE 802.3 standard for 10BASE-T includes an impulse noise specification. If you have selected 10BASE-T as the cable test standard when performing a noise test, the 802.3 requirements are used for pass/fail criteria. For all other selected cable test standards, noise will be measured but will not be judged as pass or fail.

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The table below discusses some of the common sources of noise and their solutions.

Common Causes of Noise	Solution
Electric motors	Re-route the cable or follow your installation specification.
	If in an extremely noisy environment, it may be necessary to choose an alternate medium instead of UTP (for example, coax, fiber, etc.).
Light fixtures	Same as for electric motors.
Power lines	Same as for electric motors.
RF interference	Same as for electric motors.
Data lines are shared with voice lines	Keep data lines separate from voice lines. Re-route voice lines to a different cable.

The table below discusses some common noise problems and their solutions.

Test Results	Possible Solutions
Fails noise (10BASE-T) from one end, but not the other, or noise is much greater measured from one end than from the other	The cause of the noise is closer to one end than the other.
	Perform a LENGTH test from the end that detects the noise to determine if there is an anomaly present.
	Follow the segment from the end where noise was detected and look for "*Common Causes of Noise.*"

8.2.6 IMPEDANCE
The SCAN-LAN VI does not have impedance.

8.2.7 RESISTANCE
Resistance is defined as an electrical element that impedes the flow of DC current. It is measured in ohms. As a test, it is used to confirm there are no poor connections that add to the resistance of the segment. Many times, if the resistance is not within the specification, the problem may also show up as excessive attenuation or as an impedance anomaly.

Although the SCAN-LAN VI uses TDR to measure length, Resistance can also be used as a method to measure the length of a cable if you know the rated resistance (ohms per foot or meter) of the cable. Resistance of a cable is usually rated on a per-1000-feet or per-1-km basis.

The table below discusses some common resistance problems and solutions.

Test Results	Possible Solutions
Resistance is out of specification	Compare measured value with expected value. Troubleshooting resistance should be done the same way as troubleshooting attenuation.
	See the section on Attenuation.
	All termination points should be checked. Perform a Length test to check for anomalies.

8.3 Testing Tips

8.3.1 SELECTING PERFORMANCE MODULE (PM) AND CABLE SPECIFICATION

1. Select and install the appropriate Performance Module (PM) for the type of cable under test.

2. Select the correct cable test standard you wish to test to.

If you select one of the EIA/TIA Category 3, 4, or 5 Basic Link test standards, the accuracy (Level I or Level II) will be determined by the Performance Module you use.

Level-II measurement accuracy can only be assured with the use of the 8-position modular plug PM. See **Appendix A, Test Standards,** for more explanation of the EIA/TIA TSB-67 Link Performance Standard.

8.3.2 CONNECTING THE SEGMENT UNDER TEST

CAUTION

If you see or hear an OVERVOLTAGE WARNING when connecting to a patch panel or wall plate, disconnect the unit immediately. You may have connected to a telephone line carrying ringing voltages.

The SCAN-LAN VI is designed with special protection circuitry that allows it to withstand ringing voltages with no damage. However, it is best to avoid connecting the SCAN-LAN VI to live circuits.

1. When connecting to unidentified twisted-pair cable, make sure there are no voltages on the segment. Use a tone tester or voltmeter to determine that there are no voltages on the wire.

2. Connect the remote unit to one end of the cable. Connect the main unit to the other end.

8.3.3 SELECTING THE PROPER TEST

Autotest should be used for all certification testing. Autotest verifies that all twisted-pair cable parameters meet the requirements of the cable specification selected. Autotest is also the only test other than Ethernet Traffic that can be saved for later printing.

The purpose of the Quick Check is to make sure there are no gross errors before running the longer Autotest. If there is a gross error (for example, split pair, OPEN, segment too long), you can fix the error before running the extended certification test, thus saving time.

You cannot use the Quick Check for certification testing because it does not make all the measurements necessary to ensure EIA/TIA compliance. The Quick Check was only designed as a quick test.

When testing UTP segments, the EIA/TIA Link Performance standard requires that you test NEXT from both directions. Because the link is not end-for-end symmetrical, NEXT will be different on each end. By testing from both directions, you can make sure no cable faults were missed.

If you suspect that you have a noise problem, check it from both ends of the cable.

8.3.4 INTERPRETING RESULTS

1. When testing a segment with multiple errors, do not try to interpret all the results. Start with the most obvious problem, correct it, and then re-run the test. You may see multiple faults go away by correcting one fault. For example: Your test results show a split pair and that the characteristic impedance failed. If you correct the split-pair problem first (because it is the easiest problem to troubleshoot), you may find that you have also corrected the characteristic-impedance problem.

2. If any of the tests you perform using the SCAN-LAN VI fail, use the information from the troubleshooting tables provided earlier in this chapter to determine the cause of the failure.

3. If the SCAN-LAN VI displays results you did not expect, make sure you document the result or save the test for later printout. Then, if you are unable to resolve your problem, contact Black Box.

8.4 Power Sum NEXT

Power Sum NEXT is a critical test for certifying the performance of installed twisted-pair links. It is the sum of the pair-to-pair NEXT coupled from all adjacent pairs in a cable.

Power Sum NEXT is an important measurement for emerging high-speed local area networks such as 622-Mbps ATM and Gigabit Ethernet. These networks transmit over multiple pairs at once to achieve their high data rates. Because they transmit over several pairs simultaneously, the normal pair-to-pair NEXT is not indicative of the coupled noise signal into the receive pair. Rather, the coupled signal is larger because of the multiple transmitters.

Crosstalk from multiple pairs is illustrated below.
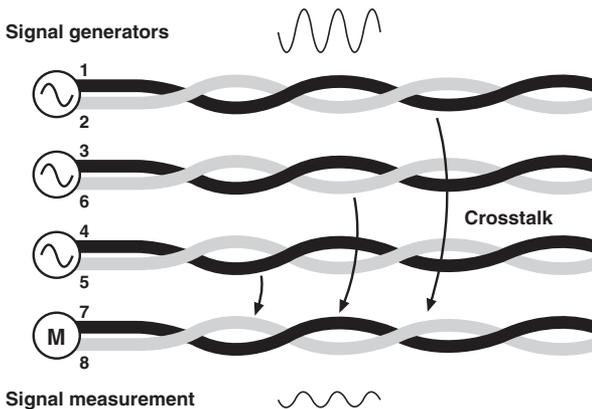
Figure 8-13. Power Sum NEXT Measurement.

Calculated Power Sum NEXT compared to pair-to-pair NEXT for a typical link is shown in Figure 8-14. Power Sum NEXT can be nearly 5 dB worse than the pair-to-pair NEXT. Consequently, the Power Sum NEXT test holds the cable up to a higher standard, providing additional assurance that the link will support future high-speed networks.
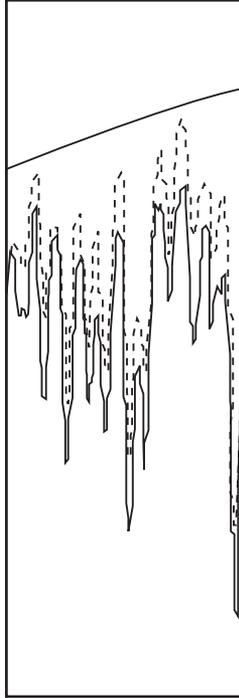
Figure 8-14. Power Sum NEXT Measurement.

The characteristics of Power Sum NEXT are very similar to those of NEXT. They both vary with frequency, are measured in decibels (a larger value is better), and are highly dependent on maintaining the wire twist up to the connector when terminating the cable.

To minimize Power Sum NEXT, you must minimize the NEXT of all pairs. Refer to the NEXT table in this chapter for some common causes of excessive NEXT and their solutions.

8.5 Delay/Delay Skew
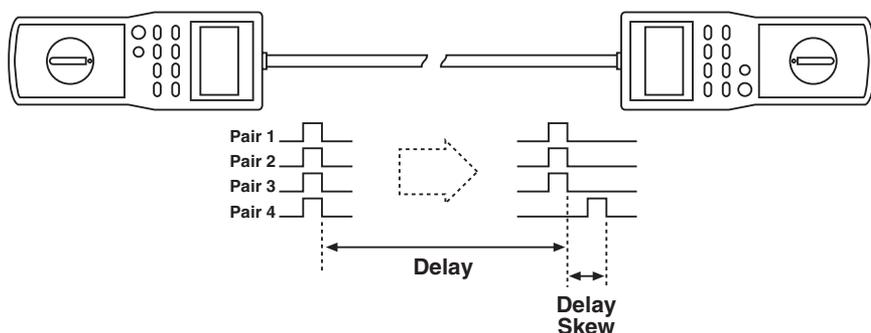
Delay is a measure of the time electrical signals take to propagate from one end of the cable to the other end. The difference in propagation delays from one cable pair to another is called Delay Skew.

Delay is important for the proper operation of many Local Area Networks, particularly Ethernet. Because of the design of these networks, too much delay can result in data re-transmissions, ultimately slowing down the network.

Delay Skew is becoming increasingly important in emerging high-speed networks such as 100BASET4, 622-Mbps ATM, and Gigabit Ethernet. To transmit data at these rates, these emerging standards use all four cable pairs while transmitting data. In order to recombine the data at the other end of the cable, these standards require that the propagation delay of all pairs be roughly equal. If there is too much difference in delay, or Delay Skew, these LANs are unable to reconstruct the data.

Test Results	Possible Solutions
Too much Delay or Delay Skew	NVP may be incorrect. Calibrate NVP and re-run the test.
	Use a higher-grade cable; higher-grade cables typically have lower propagation delays.
	If your cable is identified as 2+2 or 3+1 cable, it may have excessive Delay Skew. Contact your cable manufacturer.

9. Setup

9.1 Setup Functions

The following table provides information about the functions available under the SETUP dial position. The table details the softkey operations, the selections available for each setup parameter, and factory-set default values.

Table 9-1. Setup Functions

Function	Softkey Operations	Available Selections (Default is bold)
Units	Feet, Meters	**Feet** or Meters
Fault Thresh	Default, Dec, Inc	4 to 10% (**7%**)
Noise Thresh	Default, Dec, Inc	100 to 500 mV (**260 mV**)
PowerDown	Dec, Inc	2 to 30 min. or disabled (**5 min.**)
BackLight	Dec, Inc	15 seconds to 10 min. (**1 min.**)
Power Frequency	50 or 60 Hz	50 Hz, 60 Hz
Baud Rate	Dec, Inc	1200 to 38,400 baud (**9600 baud**)
Flow Control	None, XON/XOFF, Hardware	None, XON/XOFF, **Hardware**
Date	Format, Month, Day, Year	**mm/dd/yy**
		dd/mm/yy
		yy/mm/dd
Time	Hour, Minute,	hh:mm:ss
	Zero Seconds	(24-hour mode only)
Audible Tone	On, Off	**On** or off
TRAF/NOISE Tones	On, Off	On, **Off**
Company name	MODIFY	**Co.**
	Left, Right,	A-Z, a-z, 0-9, - , . / ( ) + * & #
	Previous, Next	*Blank*
Circuit Names	*Blank*, None, Same, NEXT	*Blank*, None, **Same**, NEXT
Auto Toner	ON, OFF	On, **OFF**
Reset to defaults	Setup, NVPs	Setup, NVP

NOTE
Display contrast can be adjusted as follows:

Hold the backlight button down while pressing the arrow keys, until the contrast is set for comfortable viewing.

9.2 Changing Setup Parameters

NOTE
Changes to the setup parameters are automatically stored in non-volatile memory. Setup settings are not lost when replacing batteries.

9.2.1 LENGTH MEASUREMENT UNITS

The Units parameter selects feet or meters for cable-length measurements.

• Switch dial to SETUP.

• Highlight Units using the arrow keys.

• Press FEET/METERS (F4) to change length units.

9.2.2 FAULT THRESHOLD

Fault Threshold is the minimum reflection level detected as an anomaly in the Length test. Any reflection less than this threshold will be ignored by the SCAN-LAN VI.

The default Fault Threshold value is 7%, which corresponds to the worst-case allowable impedance discontinuity specified in IEEE 802.3 for coaxial cable. Anomalies that are greater than this threshold may impair network transmission.

• Switch dial to SETUP.

• Highlight Fault Thresh using the arrow keys.

```
SETUP
Units            Feet
Fault Thresh        7%
Noise Thresh    260mV
PowerDown       10min
BackLight        1min
Power Frequency 60Hz
DEFAULT   DEC    INC
```

| F1 | F2 | F3 | F4 |

• Press DEFAULT (F1) to change to the factory-default value.

• Press DEC (F2) to decrease the fault threshold.

• Press INC (F3) to increase the fault threshold.

9.2.3 NOISE THRESHOLD

Noise Threshold is the minimum detection level for noise impulse spikes measured in the Noise test.

The default Noise Threshold value is 260 mV, which corresponds to the impulse-noise specification for 10BASE-T.

• Switch dial to SETUP.

• Highlight Noise Thresh using the the arrow keys.

```
SETUP
Units            Feet
Fault Thresh        7%
Noise Thresh    260mV
PowerDown       10min
BackLight        1min
Power Frequency 60Hz
DEFAULT   DEC    INC
```

| F1 | F2 | F3 | F4 |

• Press DEFAULT (F1) to change to the factory-default value.

• Press DEC (F2) to decrease the noise threshold.

• Press INC (F3) to increase the noise threshold.

9.2.4 POWERDOWN TIME

PowerDown sets the time interval for the SCAN-LAN VI's automatic power-down. The SCAN-LAN VI will power down after the time interval you select if there has either been no key press or no communication with the other end when set to remote mode. To disable PowerDown, set the value to Disabled.

• Set dial to SETUP.

• Highlight PowerDown using the the arrow keys.
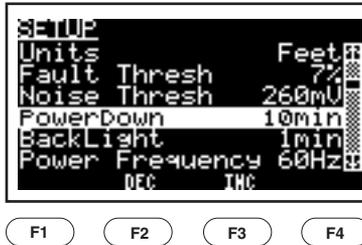
• Press DEC (F2) to shorten the time until power-down.

• Press INC (F3) to lengthen the time until power-down.

CAUTION

Auto power-down is automatically disabled during the Traffic and Noise tests. Use the AC/Mains adapter to power the SCAN-LAN VI for extended Traffic or Noise monitoring.

9.2.5 BACKLIGHT TIME

The BackLight parameter sets the "on" time for the display backlight. The backlight should be used sparingly, as it reduces the number of operation hours on a set of batteries or a battery charge.

• Set dial to SETUP.

• Highlight BackLight using the arrow keys.
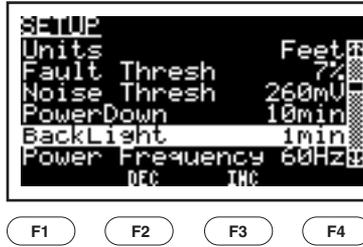
• Press DEC (F2) to shorten the time that the backlight remains on.

• Press INC (F3) to lengthen the time that the backlight remains on.

9.2.6 POWER FREQUENCY

The Power Frequency parameter is used to set the SCAN-LAN VI to match the frequency of the local AC/Mains power source.

Proper setting of Power Frequency will avoid display flicker caused by the interaction of the LCD display with room light sources. It is also used to filter noise from some measurements.

• Set dial to SETUP.

• Highlight Power Frequency using the the arrow keys.
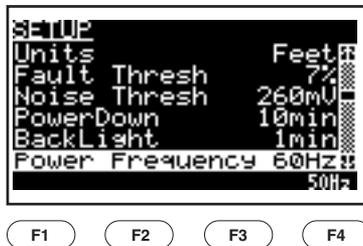
• Press 60Hz/50Hz (F4) to change the power-frequency setting.

9.2.7 BAUD RATE

The Baud Rate matches the SCAN-LAN VI serial output baud rate with that of the printer or PC. The default setting is 9600 baud, which is the most common serial-printer input baud rate.

• Set dial to SETUP.

• Highlight Baud Rate using the arrow keys.

```
SETUP
Fault Thresh        7%
Noise Thresh    260mV
PowerDown       10min
BackLight        1min
Power Frequency  60Hz
Baud Rate        9600
           DEC    INC
```

```
( F1 )   ( F2 )   ( F3 )   ( F4 )
```

• Press DEC (F2) to decrease the baud rate.

• Press INC (F3) to increase the baud rate.

9.2.8 FLOW CONTROL

Flow Control determines what method is used to control data flow between the SCAN-LAN VI and the printer or PC. The default setting is the HARDWARE flow control setting. Other available settings are: XON/XOFF, and NONE.

• Set dial to SETUP.

• Highlight FlowControl using the arrow keys.

```
SETUP
Noise Thresh    260mV
PowerDown       10min
BackLight        1min
Power Frequency  60Hz
Baud Rate        9600
FlowControl Hardware
NONE  XON/XOFF    HARDWARE
```

```
( F1 )   ( F2 )   ( F3 )   ( F4 )
```

• Press HARDWARE (F4), XON/XOFF, (F2), or NONE (F1).

9.2.9 DATE

The SCAN-LAN VI records the date when a test report is saved and includes this date on output test reports. There are three available date formats: mm/dd/yy (default), dd/mm/yy, or yy/mm/dd.

• Set dial to SETUP.

• Highlight Date using the the arrow keys.

```
SETUP
PowerDown          10min
BackLight           1min
Power Frequency    60Hz
Baud Rate          9600
FlowControl Hardware
Date         04/06/1995
FORMAT   MONTH    DAY    YEAR
```

(F1)   (F2)   (F3)   (F4)

• Press FORMAT (F1) to change the date format.

• Press MONTH to change the month.

• Press DAY to change the date.

• Press YEAR to change the year.

9.2.10 TIME

The SCAN-LAN VI maintains a 24-hour time clock. Use the 0 SEC (F4) softkey to zero the seconds.

• Set dial to SETUP.

• Highlight Time using the arrow keys.

```
SETUP
BackLight           1min
Power Frequency    60Hz
Baud Rate          9600
FlowControl Hardware
Date         04/06/1995
Time          09:15:23
         HOUR    MINUTE  0 SEC
```

(F1)   (F2)   (F3)   (F4)
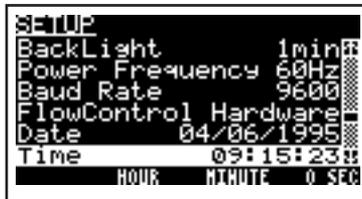
• Press HOUR (F2) to change the hour.

• Press MINUTE (F3) to change the minutes.

• Press 0 SEC (F4) to zero the seconds.

9.2.11 AUDIBLE TONES

The Audible Tones parameter enables and disables audible tones that are sounded at the end of tests, and during Traffic and Noise tests. A different audible tone is sounded for Pass and Fail test results.

• Set dial to SETUP.

• Highlight Audible Tones using the arrow keys.
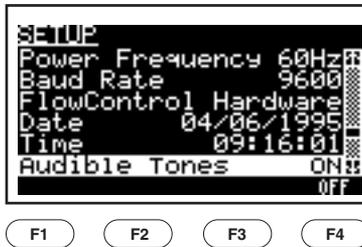
• Press ON /OFF (F4) to enable or disable the tones.

9.2.12 TRAFFIC/NOISE TONES

The Traffic/Noise Tones parameter enables and disables audible tones that are sounded during Traffic and Noise tests as activity indicators. Traffic/Noise tones are automatically disabled when the Audible Tones parameter is disabled.

 • Set dial to SETUP.

• Highlight Traffic/Noise Tone using the arrow keys.

```
SETUP
Baud Rate        9600
FlowControl Hardware
Date       04/06/1995
Time         09:16:34
Audible Tones      ON
Traf/Noise Tones OFF
                   ON
```

F1   F2   F3   F4
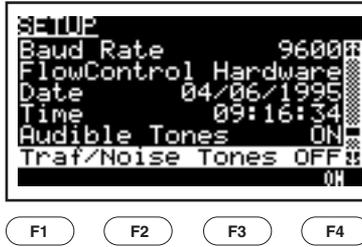
• Press ON /OFF (F4) to enable or disable the tone.

9.2.13 COMPANY NAME

Test reports can be customized to include a company name up to 20 characters long.

• Set dial to SETUP.

• Highlight "Co." using the arrow keys.

```
SETUP
FlowControl Hardware
Date       04/06/1995
Time         09:17:10
Audible Tones      ON
Traf/Noise Tones OFF
Co.
               MODIFY
```

F1   F2   F3   F4
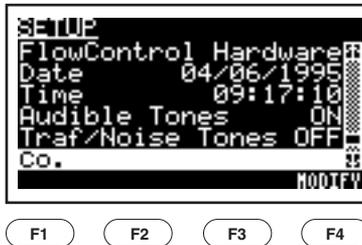
• Press MODIFY (F4) or ENTER to modify the name.

• Press LEFT (F1) or RIGHT (F4) to move the cursor.

```
COMPANY NAME
▮_____

(Press ENTER to Save)
LEFT    PREV    NEXT   RIGHT
```

F1   F2   F3   F4

• Press PREV (F2) or NEXT (F3) to enter letters or numbers.
  Hold down the key to accelerate scrolling of characters.

• Press ENTER to save the new name.

9.2.14 CIRCUIT NAMES

The Circuit Names setting determines the default name used
for the circuit identification when saving Autotest results.

- Set dial to SETUP.

- Highlight Circuit Names using the arrow keys.

- Press NONE (F1), BLANK (F2), NEXT (F3), or SAME (F4).

```
        SETUP
Audible Tones        OFF  ▲
Circuit Names       NEXT
Traf/Noise Tones     OFF
Co.
Auto Toner           OFF
Reset To Defaults         ▼
```

F1   F2   F3   F4

NONE   No Circuit ID is allowed. Reports are identified only by
           number.

BLANK User can enter Circuit ID starting with nothing.

SAME   User can enter Circuit ID starting with the last ID used.

NEXT   User can enter Circuit ID starting with the last ID used
           but with the last character "incremented."

NOTE

The string length is not changed on overflow, but the character to the left is "incremented." Letters increment to letters (...XYZABC...) and numbers increment to numbers (0123456789012...).

Example sequences:

ID-ABY	**ID-AB8**
ID-ABZ	**ID-AB9**
ID-ACA	**ID-AC0**

9.2.15 AUTO TONER

Setting Auto Toner ON activates the Cable Toner feature whenever the unit is set to Quick Check or Autotest and a remote is not attached.

• Set dial to SETUP.

• Press ON/OFF (F4) to enable or disable automatic tone generation.

```
            SETUP
   Audible Tones        ON   ↑
   Circuit Names        NEXT
   Traf/Noise Tones     OFF
   Co.
   Auto Toner           ON
   Reset To Defaults         ↓
```

F1   F2   F3   F4

9.2.16 RESET TO DEFAULTS

The Reset to Defaults parameter allows you to return the SCAN-LAN VI's internal settings to their factory-default settings.

• Set dial to SETUP.

• Highlight Reset to Defaults using the arrow keys.

• Press SETUP (F2) to reset all set up parameters to their default values (refer to Table 9-1).

• Press NVPs (F3) to reset all NVP values to their default values as shown in **Appendix B**.

9.2.17 CIRCUIT NAMES

The Circuit Names setting determines the default name used for the circuit identification when saving Autotest results.
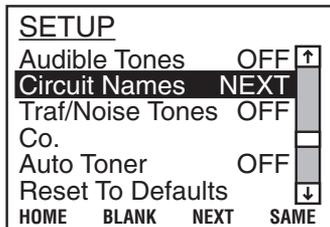
• Set dial to Setup.
• Highlight Circuit Names using the arrow keys.
• Press NONE (F1), BLANK (F2), NEXT (F3), or SAME (F4).

NONE:	No Circuit ID is allowed. Reports are identified only by number.
BLANK:	User can enter Circuit ID starting with nothing.
SAME:	User can enter Circuit ID starting with the last ID used.

NEXT: User can enter Circuit ID starting with the last ID used but with the last character "incremented."

NOTE

The string length is not changed on overflow but the character to the left is "incremented." Letters increment to letters (…XYZABC…) and numbers increment to numbers (0123456789012...).

Example sequences:

ID-ABY
ID-ABZ
ID-ACA

ID-AB8
ID-AB9
ID-AC0

10. Calibration

The SCAN-LAN VI performs four types of calibration: NVP calibration, remote-unit calibration, performance-module calibration, impedance calibration, resistance calibration, and main-unit calibration.

10.1 NVP Calibration

A default Nominal Velocity of Propagation (NVP) value is preselected in the SCAN-LAN VI depending on the cable test standard selected. More precise NVP values can be set using one of the following procedures. NVP calibration using a section of the actual cable to be tested is the more accurate of the two procedures.

10.1.1 USING A KNOWN LENGTH OF CABLE

To measure and save the NVP of a known length of cable, perform the following steps.

1. Set dial to CAL.

2. Select NVP from the calibration menu and press CAL (F4) or ENTER.

   (Press arrow keys to change the cable test standard and press SAVE (F4) or ENTER.)

3. Connect a known length of sample cable to the SCAN-LAN VI. The cable must be at least 50 feet (15.2 meters) long to get an accurate measurement (longer lengths improve accuracy). Leave the far end of the cable open.

4. Press START (F1).

5. Press DEC (F2) or INC (F3) to adjust the cable length on the display to the known cable length.

```
CALIBRATE NUP
        10Base-T
        NUP: 62.0%
   Length:    99ft
START    DEC     INC    SAVE
```
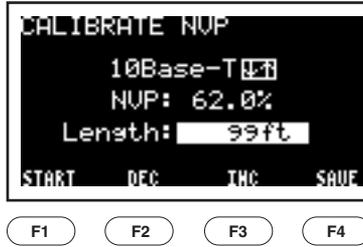

6. Press SAVE (F4) or ENTER to save the new value.

7. To repeat, press Start (F1).

8. Press ESC to exit the NVP calibration mode.

10.1.2 USING MANUFACTURER'S CABLE SPECIFICATIONS

If you do not have a known length of cable available, but can identify the cable manufacturer and part number, you may be able to determine the rated cable NVP and load that NVP value into the SCAN-LAN VI. Many common cable NVPs are listed in **Appendix B, Common NVP Values**.

To load a known NVP value:

1. Set dial to CAL.

2. Select NVP from the calibration menu and press CALIBRATE (F4) or ENTER.

```
CALIBRATE NUP
        10Base-T
        NUP: 62.0%
START    DEC     INC    DEFAULT
```
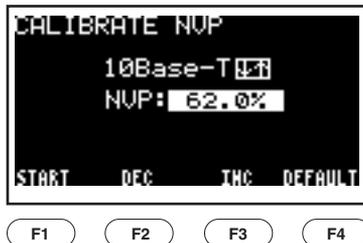

3. Press INC (F3) or DEC (F2) to adjust the NVP value.

4. Press ENTER to save the new NVP value. A message indicates that the new value has been entered.

5. Press ESC to exit the NVP calibration mode.

10.1.3 WHY DO I NEED TO SET CABLE NVP?

In order to make accurate cable-length measurements, the correct cable Nominal Velocity of Propagation (NVP) value must be set in the SCAN-LAN VI. The NVP is a measure of how fast an electrical pulse travels down a cable compared to the speed of light.

NVP is expressed as a percentage, usually between 50 and 90%. A default NVP value is automatically set by the SCAN-LAN VI based upon the cable test standard selected.

Using the default value, however, may result in cable-length measurement errors of up to 7%, due to the variation in the signal propagation rate from cable to cable. This potential length error usually will not impair troubleshooting of a cable segment that used to work unless the length measurement of a cable is close to the test limit (for example 100 meters on a 10BASE-T segment).

When using the SCAN-LAN VI for cable certification, determine the true cable NVP and save the value. This will give you the most accurate cable-length measurements and will avoid failing cable segments that are close to the test limit.

10.2 Remote-Unit Calibration

Remote-unit calibration should be performed on a periodic basis in order to maintain the accuracy of attenuation measurements. Remote calibration is most sensitive to temperature changes. Allow both main and remote units to stabilize to their operating environment before performing the calibration procedure.

Each SCAN-LAN VI is calibrated for remote operation at the factory. It's not necessary to re-calibrate the Remote unless a new SCAN-LAN VI is used for remote operation. However, if Remote Calibration is performed, it's important to verify that the calibration was completed properly.

To calibrate the remote unit:

1. Connect the main unit to the CAT 3 calibration coupler, using the Modular Plug Performance Module. (If you are using the Modular Jack Performance Module, use the four-foot CAT 5 patch cord.)

2. Connect the remote unit to the open end of the CAT 3 calibration coupler using the Modular Plug Performance Module.

3. Set the remote unit's dial to REMOTE.

4. Set the main unit's dial to CAL.

5. Highlight REMOTE in the Calibrate menu.

6. When the test is finished, the screen returns to the Calibrate menu.

NOTE

In order to ensure correct calibration, be sure to switch the roles of both units, and repeat the procedure above.

To verify the calibration:

1. Connect the main unit to the CAT 3 calibration coupler, using the Modular Plug Performance Module.

2. Connect the remote unit to the open end of the CAT 3 calibration coupler using the Modular Plug Performance Module.

3. Turn the knob to Quick √. Press the up or down arrow key to select the CAT 5 Basic Link test standard. Press ENTER or SAVE (F4) to start the test.

4. Once the test is complete, press VIEW (F3). Press the up or down arrow key until the Attenuation results are displayed. The Attenuation results should display values greater than 0.0 dB. If 0.0 dB is displayed for any or all pairs, perform the Remote Calibration again. If the problem continues, contact Black Box.

10.3 Performance-Module Calibration

Each Performance Module used with the SCAN-LAN VI needs to be calibrated in order to deliver maximum measurement accuracy. SCAN-LAN VI automatically recognizes which type of Performance Module is installed. It is possible for the SCAN-LAN VI to be calibrated to a number of Performance Modules at the same time, provided that they are different types. For example, the SCAN-LAN VI can be calibrated to both a Modular Plug Module and a Modular Jack Module, thus allowing change from one Performance Module to the other without need for recalibration. If a

Performance Module is replaced with another of the same type, however, calibration of the new Performance Module should be performed.

A Calibration Standard is available for convenient field calibration of twisted-pair Performance Modules. This Standard also enables you at any time to perform a "confidence check" on the proper operation of a Performance Module by repeating the calibration procedure.

To calibrate a Performance Module:

NOTE
Press ESC at any time to cancel the calibration procedure.

1. Set dial to CAL.

2. Highlight PERFORMANCE MODULE in the Calibrate menu using the arrow keys.

3. Press CALIBRATE (F4) or ENTER. The CALIBRATE PERFORMANCE MODULE screen will appear with the displayed message "Connect To JACK 1."

4. Connect the SCAN-LAN VI to JACK 1 of the Calibration Standard. (Use a Category 5 Patch Cord for connecting a Modular Jack Performance Module to the Calibration Standard.)

5. Press START (F4) or ENTER. The message "CALIBRATING..." will be displayed on the screen. The bar graph across the bottom of the display will show the progress of the calibration. Press CANCEL (F1) or ESC to cancel the calibration procedure.

6. After approximately 45 seconds, the SCAN-LAN VI will display the message "Connect To JACK 2." Remove the plug from JACK 1 and insert it into JACK 2.

7. Press CONTINUE (F4) or ENTER. The message "CALIBRATING..." will be displayed, and the bar graph across the bottom of the display will show the progress of the calibration. Press CANCEL (F1) or ESC to cancel the calibration procedure.

8. After approximately 45 seconds, the SCAN-LAN VI will display the message "Connect To JACK 3." Remove the plug from JACK 2 and insert it into JACK 3.

9. Press CONTINUE (F4) or ENTER. The message "CALIBRATING..." will be displayed, and the bar graph across the bottom of the display will show the progress of the calibration. Press CANCEL (F1) or ESC to cancel the calibration procedure. When finished, the screen returns to the CALIBRATE menu.

NOTE

If at any time during the above procedure an error message is displayed on the screen, start at the beginning of the instructions and attempt the calibration again. If the problem continues, contact Black Box for technical support.

10.4 Impedance Calibration

The SCAN-LAN VI does not support impedance calibration.

10.5 Resistance Calibration

Resistance calibration should be performed on a periodic basis in order to maintain maximum accuracy. Resistance calibration is most sensitive to temperature changes. Allow the main unit to stabilize to the operating environment before performing the calibration procedure. Calibration should be performed whenever a different Performance Module is installed.

To calibrate Resistance:

1. Connect the SCAN-LAN VI to the Remote Unit.

2. Set the dial to CAL.

3. Highlight Resistance in the Calibrate menu by using the arrow keys.

4. Press CALIBRATE (F4) or ENTER. The Calibrate Resistance screen will appear. The bar graph across the bottom of the display will show the progress of the calibration.

5. When finished, the screen returns to the CALIBRATE menu.

10.6 Main-Unit Calibration

This calibration mode is intended for factory use only.

11. Ethernet Traffic Analysis

Traffic provides a report of Ethernet network utilization and activity.

The SCAN-LAN VI monitors live traffic on 10BASE-T Ethernet networks and continuously displays the percentage of network utilization, peak traffic, and collisions on the screen along with a bar-graph display of network activity. An audio tone provides feedback of network activity.

Test results are saved in the SCAN-LAN VI's memory and can be printed when the test is completed. The printout includes a graph of network activity over time showing average utilization, peak utilization, percentage of collisions, packet counts, and jabber conditions. For 10BASE-T networks, the SCAN-LAN VI automatically generates link pulses to activate the hub and reports whenever a link state with the hub is lost.

Because the Traffic test runs continuously, use the AC/Mains adapter if the test is to be run for an extended period.

The SCAN-LAN VI's Traffic test reports: Network utilization percentage, peak traffic, and collisions.

The Traffic test also detects: Jabber, loss of link connections (10BASE-T), and wrong polarity.

11.1 Running the Traffic Test

1. Connect the SCAN-LAN VI directly to the network either at the 10BASE-T hub or at the end of a cable segment.

2. Switch dial to TRAFFIC. (Press arrow keys to change the cable test standard and SAVE (F4) or ENTER to select a cable test standard.)

3. Press ENTER to clear the last Traffic test from memory and start a new test.

CAUTION

Auto power-down is disabled during the Traffic test. Use the AC/Mains adapter to power the SCAN-LAN VI for extended Traffic monitoring.

11.2 Viewing Traffic Results

The screen displays a continuous reading of traffic conditions on the network.

FEATURE	DESCRIPTION
One Sec Traffic	Shows the average network utilization over the last second. Average traffic utilization over 30 to 40% indicates a heavily loaded network.
Peak Traffic	The highest one-second average traffic over the duration of the test.
Collisions	Shows the current collisions rate over the last second, expressed as a percentage of total packets transmitted. Collisions are counted when runt packets (shorter than a valid minimum packet length) are detected.
	Collision rates exceeding 3% may indicate a faulty station or network interface card, or an excessively long cable segment.
Last Error	Identifies detected transmission errors and the time since the last error ended in hours, minutes, and seconds.
Error Since	Identifies detected transmission errors and the time the error started in hours, minutes, and seconds.
Bar Graph	Displays the current traffic level, scaled from 0 on the left to 50% on the right side of the display.

Traffic test can detect the following three errors:

ERROR	DESCRIPTION
No Link Pulse	Indicates that there were no Link pulses received from the 10BASE-T hub, possibly as a result of a faulty hub or cable link connected to the hub.
Wrong polarity	Indicates possible miswire of cable link or hub port caused by tip/ring reversal on a wire pair.
Jabber	Indicates illegal packet length of greater than 20 ms was received. This suggests a faulty network interface card.

Figure 11-1. Traffic Test Results Screen (Wrong Polarity).

```
TRAFFIC        00:00:03
One Sec Traffic:     0%
Peak Traffic:        0%
Collisions:          0%
Last Error:  00:00:01
      Wrong polarity
0 ▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮  50%
```
F1   F2   F3   F4

Figure 11-2. Traffic Test Results Screen (No Link Pulse).

```
TRAFFIC        00:00:03
One Sec Traffic:     0%
Peak Traffic:        0%
Collisions:          0%
Error Since: 00:00:01
      No link pulse
0 ▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮  50%
```
F1   F2   F3   F4

Figure 11-3. Traffic Test Results Screen (Jabber Detected).

```
TRAFFIC        00:00:26
One Sec Traffic:    69%
Peak Traffic:       69%
Collisions:          0%
Last Error:  00:00:01
     Jabber detected
0 ▮                 50%
```
F1   F2   F3   F4

NOTE

The "Error Since" message indicates the time when the present traffic error began. The "Last Error" message indicates the time since the last error occurred. There is no current error present.

12. Self-Test

If the SCAN-LAN VI fails to operate as expected, or exhibits inaccurate readings, perform a self-test.

To run a self-test:

1. Set the dial to EXTENDED FUNCTIONS.

2. Press the arrow keys to highlight SELF-TEST.

3. Press ENTER. The test begins immediately and the screen displays the test results.

If the self-test fails, make a note of which test fails and contact Black Box.

If the SCAN-LAN VI passes the self-test, but still does not perform properly, perform the calibration procedure (refer to **Chapter 10, Calibration**). If you continue to experience problems, make a note of the circumstances and print a cable report, if applicable. Then call Black Box.

You must obtain a Return Material Authorization (RMA) number before sending the unit in for repair.

13. Talk and Test Modules for the SCAN-LAN VI

13.1 Introduction

The Talk and Test Module for the SCAN-LAN VI certifies multimode fiber pairs by comparing bi-directional dual-wavelength 850/1300-nm loss, length, and propagation delay measurements against several industry standards. The Talk and Test Module also provides interpretation-free pass/fail results. And these modules take advantage of the SCAN-LAN VI's integrated 2-way talk set, permitting operators at opposite ends of the fiberoptic link to communicate without dependency on 2-way radios.

The Talk and Test Module complies with the requirements of TIA 568A, ISO 11801, and provides pass/fail determination for a variety of fiber applications. The Test and Talk Module uses a link-loss budget calculation as part of the pass/fail determination.

The SCAN-LAN VI cable tester can save up to 800 fiber-pair test records. These reports can then be uploaded to a PC using RMS (Report Manager Software), provided free of charge with the SCAN-LAN VI.

13.2 Installing the Talk and Test Module

Turn off power to the SCAN-LAN VI before adding or changing modules.

To remove a module, loosen the thumbscrews at either side of the module until the screws are free of the retainers. Hold the module on either side and slide it out of the opening. To install a module, slide it into the opening until the screws rest against the retainers, then hand-tighten the screws until the module is properly seated.
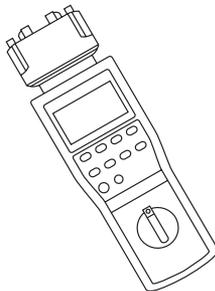
CAUTION

Avoid damaging the SCAN-LAN VI's case. Tighten the screws evenly using finger pressure only. Make sure to either turn both screws simultaneously or alternately in small increments. The module is designed to be installed or removed without tools.

13.3 Test Setup

One SCAN-LAN VI handset is used as the Remote Unit. Set its dial to REMOTE.

The other SCAN-LAN VI handset is used as the Main Unit. Before you begin a certification test, it's important to properly configure the Main Unit to your specific configuration as described below. All of the following options offer a default setting, which can be customized.

LENGTH MEASUREMENTS UNITS

Cable length can be measured in feet or meters.

```
SETUP
Units               Feet
Fault Thresh         7%
Noise Thresh       260mV
PowerDown          10min
BackLight           1min
Power Frequency     60Hz
                   METERS

 ( F1 )  ( F2 )  ( F3 )  ( F4 )
```
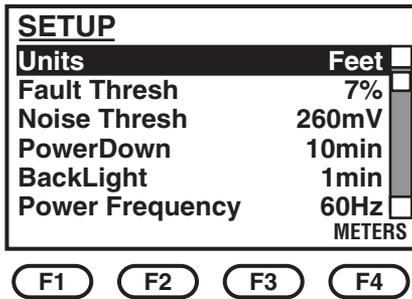
- Set the Main Unit dial to SETUP.

- Highlight **Units** using the ↑↓ keys.

- Press FEET/METERS (F4) to change the length units.

NOTE

Refer to Chapter 9 for directions on other SETUP operation settings.

INDEX OF REFRACTION

Set the Index of Refraction (IOR) each time you test a cable from a different manufacturer or spool.

Attach the launch cables to TX (transmit) and RX (receive) ports on each handset as shown in **Section 13.5**. Note that TX on one unit connects to RX on the other.

- Set the Main Unit dial to CAL.

- Highlight **IOR** with the ↑↓ keys.

- Press CALIBRATE (F4).

```
 _____
| CALIBRATE                      |
| IOR                         ⬇  |
| SCAN-LAN IV                    |
|                                |
|                                |
|                     CALIBRATE  |
|_____|
   ( F1 )  ( F2 )  ( F3 )  ( F4 )
```
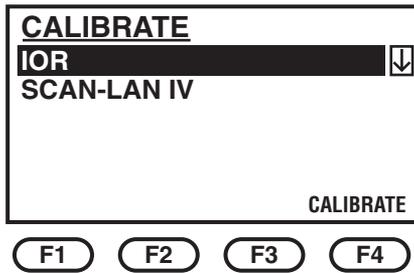
You can use system-default IOR settings, manually input new settings, or calculate the correct IOR based on a known length of cable.

- Press DEFAULT (F4) to use the default settings, or

- Press DEC (F2) or INC (F3) to manually change the IOR setting, or

- To set IOR based on a known length of cable: Connect a cable of known length to TX and RX on the main unit.

```
 _____
| CALIBRATE  IOR                 |
|  568A  Horizontal  Lnk   ⬇⬆    |
|          NVP:   1.490          |
|                                |
|      Press Enter To Save       |
| START    DEC      INC   DEFAULT|
|_____|
   ( F1 )  ( F2 )  ( F3 )  ( F4 )
```

SETTING LOSS BUDGET
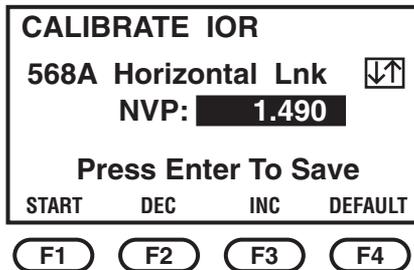
With this function you can input the number of connectors and splices for the link under test, and the core diameter. This allows the tester to automatically calculate pass/fail limits based on test standards and allowable losses for these components. These values will be used for all links to be tested.

- Press BUDGET (F1).

- Highlight **# of Connectors** with the ↑↓ keys.

- Press DEC (F2) or INC (F3) to set the number of connectors.

- Repeat for **# of Splices**.

```
┌─────────────────────────────────┐
│ FIBER OPTIONS                   │
│ # of Connectors            2 ▯  │
│ # of Splices               0 ▮  │
│ Core Diameter           62.5 ▮  │
│                              ▮  │
│          DEC      INC        ▯  │
└─────────────────────────────────┘
    ( F1 )   ( F2 )   ( F3 )   ( F4 )
```

- Highlight **Core Diameter** with the ↑↓ keys.

- Select 50 (F2) or 62.5 (F3).

- Press ESC to return to the Power screen.

CABLE STANDARD

On the LOSS, POWER, and MARGIN display screens, a test standard will be displayed with an up and down arrow ($\uparrow\downarrow$). Using these standards allows the Talk and Test Module to automatically determine pass/fail loss and length limits. At any time, you can use the arrow keys to select a new cable standard.

```
 ┌─────────────────────────────┐
 │ CHANGE CABLE STANDARD       │
 │  RG-59                    □  │
 │  RG-59 Foam                 │
 │  RG-62 (Arcnet)             │
 │  FIBER                      │
 │ √568A Horizontal Lnk      ▓ │
 │  568A Backbone Link       □  │
 │              PGDN     SELECT │
 └─────────────────────────────┘
   ( F1 )   ( F2 )   ( F3 )   ( F4 )
```
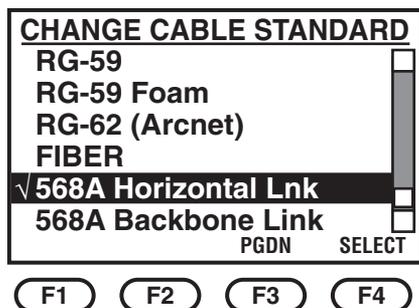
13.4 Set Reference Power

Set Reference should be performed prior to testing. This function saves the loss from the launch and subtracts them from the values of the actual cable under test.

The following reference setting procedure follows Method B per TIA/EIA-526-14A (OFSTP-14A), also called the "One Jumper Reference."

The Talk and Test Module measures both references simultaneously. One reference is from the Main to the Remote, using Launch Cable A, as shown in the figure on the next page. The other reference is from the Remote to the Main, using Launch Cable B.

NOTE

Once the reference measurement has been made and you are ready to begin testing, disconnect the launch cables as illustrated on the next page. Do not disconnect the launch cables from the Transmit TX ports after the Reference powers have been set.

- Press SETREF (F4) from the Power screen. The tester will return to the Loss screen after setting the reference.

```
POWER  dBm
568A  Horizontal  Lnk    ↓↑
___RX_____TX___
-23.64        850nm        -27.35
-13.85        1300nm       -19.68


BUDGET      LOSS        TALK      SETREF
```

(F1)   (F2)   (F3)   (F4)
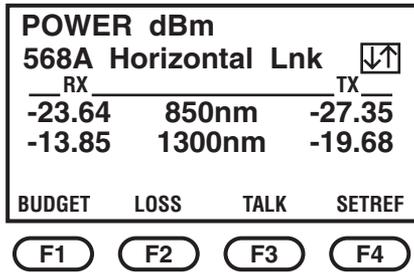
To establish a new reference after initially setting the reference, return to the Power screen by pressing ESC while the Loss screen is shown.

Method B
Setting the Reference

◄──── Light Direction ───────

◄ Test Jumper (850/1300 nm) ◄───

► Test Jumper (850/1300 nm) ───►

RX TX   ──── Light Direction ────►   RX TX
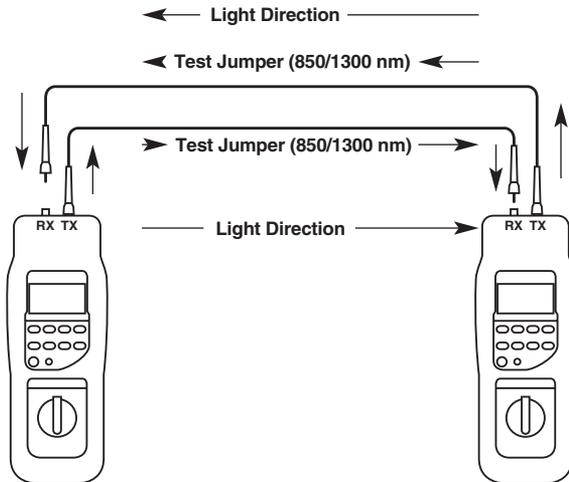
NOTES

It's important to maintain the connection to the Tx port on both ends once the reference measurement has been made.

While the Talk and Test Module has been designed to compensate for changes in ambient temperature, for optimum performance, you should re-establish the reference if there is a significant change in temperature since the reference was established.

13.5 Fiberoptic Cable Testing per TIA OFSTP-14A Method B

Measuring the Fiber Link
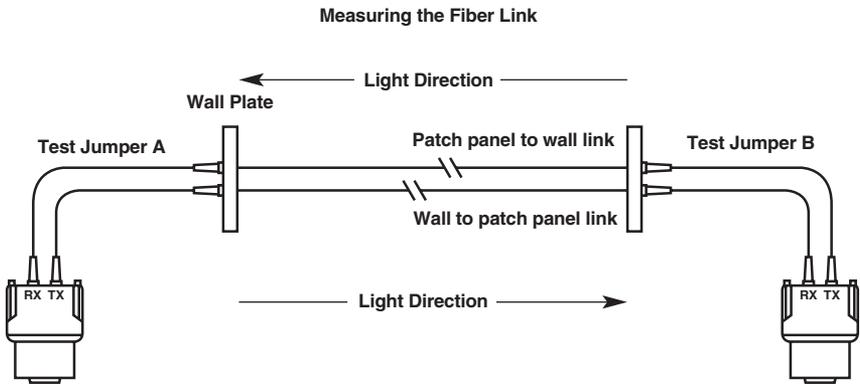
TIA OFSTP-14A measures the installed fiber attenuation plus the loss of the Test Jumper. This is the specified method for testing the multimode cable under TIA/EIA-568A and ISO/JEC 11801, and is appropriate when measuring a cable plant with patch panels on both ends, or with a patch panel at one end and a wall outlet at the other.

Method B Link Loss includes:

• Link Loss from wall outlet to patch panel + two connector losses + Test Jumper A loss.

• Link loss from wall outlet to patch panel + two connector losses + Test Jumper B loss.

13.6 Autotest

Make sure that the Main and Remote Units are connected as shown in **Section 13.5**.

POWER MEASUREMENT

- Set the Main Unit dial to AUTOTEST. The unit displays the power received for both Rx and Tx at both 850 and 1300 nm.

```
┌─────────────────────────────────┐
│ POWER  dBm                      │
│ 568A  Horizontal  Lnk    ↓↑     │
│  ___RX_____TX___ │
│ -23.64      850nm      -27.35   │
│ -13.85      1300nm     -19.68   │
│                                 │
│ BUDGET    LOSS     TALK   SETREF │
└─────────────────────────────────┘
     ( F1 )   ( F2 )   ( F3 )   ( F4 )
```

LOSS AND MARGIN TESTS

• Press LOSS (F2). The Loss screen displays the power lost in dBm at both
  wavelengths for both cables, due to attenuation in the cables under test.

```
┌─────────────────────────────┐
│ LOSS (-) dB         PASS     │
│ 568A Backbone Link   ↓↑      │
│ __RX_____TX__    │
│ + 0.94     850nm    + 1.29   │
│ + 0.47     1300nm   + 1.30   │
│        339 FT/502 NS         │
│ BUDGET  MARGIN   TALK   SAVE │
└─────────────────────────────┘
    (F1)   (F2)   (F3)   (F4)
```
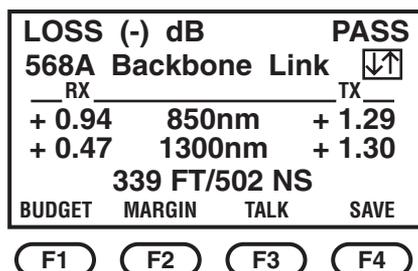
• From the Loss screen, press MARGIN (F2).

```
┌─────────────────────────────┐
│ LOSS MARGIN dB      PASS     │
│ 568A Backbone Link   ↓↑      │
│ __RX_____TX__    │
│ + 0.94     850nm    + 0.59   │
│ + 1.19     1300nm   + 0.34   │
│        339 FT/502 NS         │
│ BUDGET   LOSS    TALK   SAVE │
└─────────────────────────────┘
    (F1)   (F2)   (F3)   (F4)
```
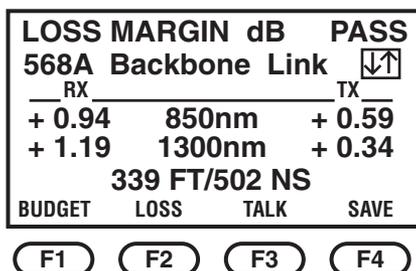
The Margin screen displays the amount of headroom between the allowable loss
in the selected cable standard and the measured loss in the cables under test.

The margins for both wavelengths (where appropriate) for both cables is
displayed.

NOTE
All failing test results will be displayed in reverse video.

13.7 Saving an Autotest

Since measurements on two separate cables are being performed, you must input a circuit ID name for each cable tested.

```
AUTOTEST SAVE
        TX
    Report #002 ↓↑
  (Press ENTER To Save)
    ID: ■_____

LEFT      PREV      NEXT      RIGHT
```
(F1)   (F2)   (F3)   (F4)

```
AUTOTEST SAVE
        RX
    Report #002 ↓↑
  (Press ENTER To Save)
    ID: ■_____

LEFT      PREV      NEXT      RIGHT
```
(F1)   (F2)   (F3)   (F4)

NOTE

Please refer to Chapter 4 for details on how to save an Autotest.

NOTE

Test report "Tx" designates measurements made on the fiber connected to the Tx port of the Main Unit. Test report "Rx" designates measurements made on the fiber connected to the Rx port of the Main Unit.

13.8 Printing, Uploading, and Viewing Test Results

You can view or print test results from the Main Unit, or upload the results to a PC for viewing or printing with Report Manager software.

13.9 LinkTalk

LinkTalk allows two Talk and Test units to function as an audio communication system. This feature provides half-duplex voice communication between the Main and Remote Units. Refer to **Section 4.5** for more information on LinkTalk.

Appendix A: Test Standards

The SCAN-LAN VI tests cabling to the performance required by the cable test standard chosen. The test limits for each specification standard are listed in the tables in this appendix.

SCAN-LAN VI cable test standards may be modified to add/remove cable tests (for example, cable resistance) and modify which pairs are tested.

A.1 Installed Link Test Configurations

Cabling-system performance requirements have been established by the industry association EIA/TIA in Technical Systems Bulletin 67. TSB-67 also defines two installed cabling test configurations, the Channel and the Basic Link.

The primary difference between the Channel and the Basic Link configurations is that the Channel includes the user's patch cords and equipment cords used to connect to the workstation (at the office end) and to the communications distribution equipment/hub (at the wiring closet). The Basic Link excludes the user's patch cords and equipment cords.

A.2 Channel Testing

You use the Channel configuration when the need arises to diagnose system problems in existing networks.

The figure on the next page illustrates a typical test setup using two SCAN-LAN VI to test a Channel.
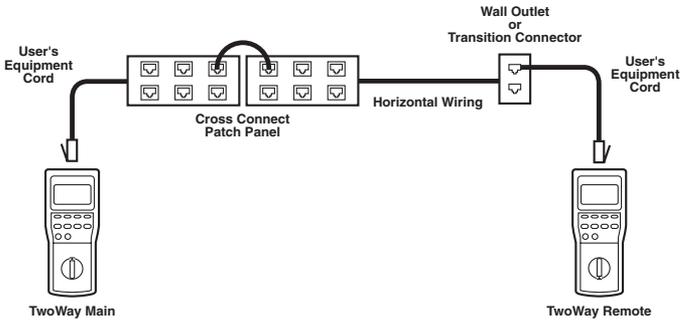
A.3 Basic Link Testing

You use the Basic Link configuration when a new installation is to be certified for conformance to the cabling-system performance requirements of TSB-67. The Modular Plug Performance Module is used in this arrangement.

The following figure illustrates a typical test setup using two SCAN-LAN VI to test a Basic Link.
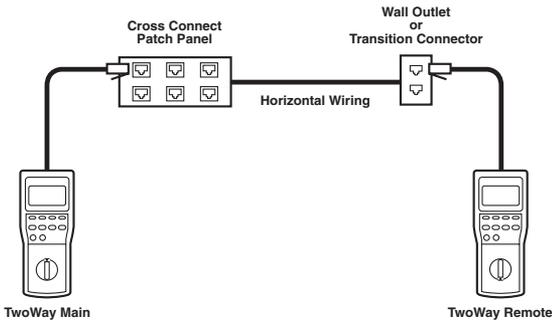
A.4 EIA/TIA TSB-67—Test Limits

When testing to Category 3, Category 4, or Category 5 UTP limits, the cable category as well as the Cable Test Configuration is chosen from the Cable Test Standards menu. To test the Channel, including user patch and equipment cords, use the Modular Jack Performance Module and test to Level-I accuracy. The Basic Link can be tested to Level-I accuracy with the Modular Jack Performance Module or it can be tested to Level-II accuracy with the Modular Plug Performance Module. (Level II is higher in performance than Level I. It is not possible to attain Level-II accuracy using the Modular Jack Performance Module.)

Table A-1. Attenuation

Frequency MHz	Category 3 (dB)		Category 4 (dB)		Category 5 (dB)	
	Channel	Link	Channel	Link	Channel	Link
1	4.2	3.2	2.6	2.2	2.5	2.1
4	7.3	6.1	4.8	4.3	4.5	4
8	10.2	8.8	6.7	6	6.3	5.7
10	11.5	10	7.5	6.8	7	6.3
16	14.9	13.2	9.9	8.8	9.2	8.2
20			11	9.9	10.3	9.2
25					11.4	10.3
31.25					12.8	11.5
62.5					18.5	16.7
100					24	21.6

Table A-2. NEXT

Frequency MHz	Category 3 (dB)		Category 4 (dB)		Category 5 (dB)	
	Channel	Link	Channel	Link	Channel	Link
1	39.1	40.1	53.3	54.7	>60	>60
4	29.3	30.7	43.3	45.1	50.6	51.8
8	24.3	25.9	38.2	40.2	45.6	47.1
10	22.7	24.3	36.6	38.6	44	45.5
16	19.3	21	33.1	35.3	40.6	42.3
20			31.4	33.7	39	40.7
25					37.4	39.1
31.25					35.7	37.6
62.5					30.6	32.7
100					27.1	29.3

Table A-3. CAT3, CAT4, and CAT5 Pass/Fail Limits

Length	Channel: ≤100 meters, Link: ≤94 meters
Characteristic Impedance	100±25Ω
Split Pair	NEXT<20 dB (8 to 10 MHz)
Resistance	<9.9Ω

A.5 ISO/IEC—Test Limits

Cabling System performance criteria have been established internationally by the ISO/IEC Standards body in the ISO/IEC 11801 Standard. The 11801 Standard establishes two applications referred to as Class C and Class D. Cabling Links supporting Class C applications are specified up to 16 MHz. Cabling Links supporting Class D applications are specified up to 100 MHz.

When testing to Class C or Class D limits, use of the Modular Plug Performance Module is recommended. If testing of the user patch cords is required, the Modular Jack Performance Module can be used with reduced accuracy.

NOTE
ScTP Class D and ISO 11801 Class D are equivalent, with the exception that ScTP requires shield continuity.

Table A-4. ISO/IEC 11801 Pass/Fail Limits

Frequency (MHz)	Max. Attenuation Values (dB)		Min. NEXT Loss (dB)	
	Class C	Class D	Class C	Class D
1	3.7	2.5	39	54
4	6.6	4.8	29	45
10	10.7	7.5	23	39
16	14	9.4	19	36
20	N/A	10.5	N/A	35
31.25	N/A	13.1	N/A	32
62.5	N/A	18.4	N/A	27
100	N/A	23.2	N/A	24

Table A-5. ISO 11801 Class C, Class D ACR Test Limits

Frequency (MHz)	Minimum ACR (dB)	
	Class C	Class D
1	35.3	—
4	22.4	40
10	12.3	35
16	5	30
20	—	28
31.25	—	23
62.5	—	13
100	—	4

Table A-6. ISO 11801 Class C, Class D Pass/Fail Limits

Length	100 meters
Characteristic Impedance	100±25 Ω
Split Pair	20 dB
Resistance	<20.5 Ω

A.6 Enhanced Cable Standards—Test Limits

SCAN-LAN VI includes several enhanced Cable Test Standards. All enhanced cable standards are designated as "Plus" cable standards (for example, Cat 5 Plus BasicLink. ISO Class D Plus). "Plus" cable test standards include Power Sum NEXT and Delay/Delay Skew tests along with the standard suite of tests. "Plus" Cable Test standards test the cable to a higher standard than the standards they are based on (for example, CAT 5, Class D) and are intended for testing the new emerging enhanced data cable (sometimes referred to as 350 cabling).

Power Sum NEXT test limits for "Plus" cable standards are identical to the pair-to-pair test limit of the base cable standard. All other test limits are the same.

A.7 IEEE Twisted Pair—Test Limits

IEEE 802.3 and 802.5 Standards specify cabling performance required for proper operation of Ethernet and Token-Ring networks, respectively. SCAN-LAN VI checks against the following limits when those wiring systems are invoked from the menu. These systems can be tested with either the plug or jack interface.

NOTE

When diagnosing wiring problems on existing Ethernet or Token-Ring networks, it is appropriate to test to the IEEE standard for that particular network despite the probability that wiring originally may have been certified to some higher performance category.

The benefit of testing in this manner is that a good deal of time will be saved when diagnosing cabling performance for the needed frequencies rather than attempting to re-certify wiring for performance that is higher than needed for the network to operate properly.

Table A-7. 10BASE-T Pass/Fail Limits

Length	≤100 meters
Resistance	<9.9 Ω
Characteristic Impedance	100±25 Ω
NEXT	>31 dB @ 5 MHz
	>27 dB @ 8 MHz
	>26 dB @ 10 MHz
	(NEXT >26-15log(f/10)
	where: f = signal frequency in MHz)
Attenuation	<11.5 dB
Split Pair	NEXT <20 dB (8 to 10 MHz)

Table A-8. 4-Mbps Token Ring UTP Pass/Fail Limits

Length	≤100 meters
Resistance	<9.9 Ω
Characteristic Impedance	100±25 Ω
NEXT	>31 dB @ 5 MHz
	>28 dB @ 8 MHz
	>26 dB @ 10 MHz
Attenuation	<7 dB @ 5 MHz
	<9 dB @ 8 MHz
	<10 dB @ 10 MHz
Split Pair	NEXT <20 dB (8 to 10 MHz)

Table A-9. 16-Mbps Token Ring UTP Pass/Fail Limits

Length	≤100 meters
Resistance	<9.9 Ω
Characteristic Impedance	100±25 Ω
NEXT	>41 dB @ 5 MHz
	>38 dB @ 8 MHz
	>36 dB @ 10 MHz
	>33 dB @ 16 MHz
	>32 dB @ 20 MHz
Attenuation	<5 dB @ 5 MHz
	<6 dB @ 8 MHz
	<7 dB @ 10 MHz
	<9 dB @ 16 MHz
	<11 dB @ 20 MHz
Split Pair	NEXT <20 dB (8 to 10 MHz)

Table A-10. Token Ring STP Pass/Fail Limits

Length	≤100 meters
Characteristic Impedance	150±25Ω
NEXT	Between 1 and 16 MHz, NEXT >35 dB
Attenuation	Between 1 and 16 MHz, Attenuation <8.5 dB
Split Pair	NEXT <20 dB (8 to 10 MHz)
Resistance	<7 Ω

Table A-11. 100BASE-TX Pass/Fail Limits

Characteristic Impedance	$100\pm25\Omega$
NEXT	Between 1 and 100 MHz, NEXT >Category 5 Channel Limits
Attenuation	Between 1 and 100 MHz, Attenuation <Category 5 Channel Limits
Split Pair	NEXT <20 dB (8 to 10 MHz)
Resistance	<9.9Ω
Length	≤100 meters

Table A-12. 100BASE T4 Pass/Fail Limits

Length	≤100 meters
Characteristic Impedance	$100\pm25\Omega$
NEXT	Between 1 and 16 MHz, NEXT >Category 3 Channel Limits
Attenuation	Between 1 and 16 MHz, Attenuation <Category 3 Channel Limits
Split Pair	20 dB
Resistance	<9.9Ω

Table A-13. TP PMD and TP PMD-REV Pass/Fail Limits

Length	≤100 meters
Characteristic Impedance	$100\pm25\Omega$
NEXT	Between 1 and 100 MHz, NEXT >Category 5 Channel Limits
Attenuation	Between 1 and 100 MHz, Attenuation <Category 5 Channel Limits
Split Pair	20 dB
Resistance	<9.9Ω

Table A-14. ISO 11801 Class C Pass/Fail Limits

Length	≤100 meters
Characteristic Impedance	100±25Ω
NEXT	Between 1 and 16 MHz, NEXT >ISO 11801 Class C Limits
Attenuation	Between 1 and 16 MHz, Attenuation <ISO 11801 Class C Limits
Split Pair	20 dB
Resistance	<9.9Ω

Table A-15. ISO 11801 Class D Pass/Fail Limits

Length	≤100 meters
Characteristic Impedance	100±25Ω
NEXT	Between 1 and 100 MHz NEXT >ISO 11801 Class D Limits
Attenuation	Between 1 and 100 MHz, Attenuation <ISO 11801 Class D Limits
Split Pair	20 dB
Resistance	<9.9Ω

Table A-16. ScTP Class C Pass/Fail Limits

Length	≤100 meters
Characteristic Impedance	100±25Ω
NEXT	Between 1 and 16 MHz, NEXT >ISO 11801 Class C Limits
Attenuation	Between 1 and 16 MHz, Attenuation <ISO 11801 Class C Limits
Split Pair	20 dB
Resistance	<9.9Ω

Table A-17. ScTP Class D Pass/Fail Limits

Length	≤100 meters
Characteristic Impedance	100±25Ω
NEXT	Between 1 and 100 MHz, NEXT >ISO 11801 Class D Limits
Attenuation	Between 1 and 100 MHz, Attenuation <ISO 11801 Class D Limits
Split Pair	20 dB
Resistance	<9.9Ω

Table A-18. FTP 120Ω Pass/Fail Limits

Length	≤100 meters
Characteristic Impedance	120±25Ω
NEXT	Between 1 and 100 MHz, NEXT >ISO 11801 Class D Limits
Attenuation	Between 1 and 100 MHz, Attenuation <ISO 11801 Class D Limits
Split Pair	20 dB
Resistance	<20.5 Ω

Table A-19. ATM 155 Mbps Pass/Fail Limits

|	
Length	≤100 meters
Characteristic Impedance	100Ω
NEXT	Between 1 and 100 MHz, NEXT >Category 5 Limits
Attenuation	Between 1 and 100 MHz, Attenuation <Category 5 Limits
Split Pair	20 dB
Resistance	<9.9Ω

A.8 Defining Custom Standards

Existing cable test standards can be modified to create additional custom standards. Custom Standards that have been defined by the user are then available as Cable Standards and are identified by asterisks (*).

The tests performed and the PASS/FAIL limits are set by copying one of the existing cable test standards. The customization consists of selecting which pairs will be included in the tests and which tests will be performed.

To create a custom standard:

1. Set the dial to Autotest, Quick √, Wire Map, Length, or Traffic.

2. Press either arrow key to display the cable standard library.

```
┌─────────────────────────┐
│ Change Cable Standard   │
│  CAT5  Channel      ↑   │
│ √CAT5  Basic Link       │
│  CAT4  Channel          │
│  CAT4  Basic Link       │
│  CAT3  Channel          │
│  CAT3  Basic Link   ↓   │
│      EDIT   PGDM  SELECT │
└─────────────────────────┘
   (F1)  (F2)  (F3)  (F4)
```
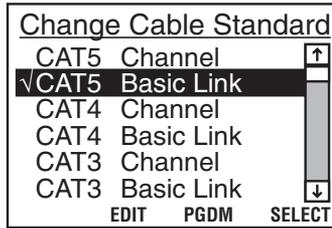
3. Select a test standard to copy for the new custom test standard, then press EDIT (F2).

4. Press SELECT/DESELECT (F3) to choose the tests that will be performed. Press either arrow key to move up or down the list.

   Selected tests (indicated by a √ mark) will be included in the custom test.

```
┌──────────────────────────────┐
│ Select Tests                 │
│ √REMOTE SEARCH         ↑     │
│ √WIRE MAP                    │
│ √LENGTH                      │
│  DELAY                       │
│  DELAY SKEW                  │
│ ‡ Requires TwoWay Remote  ↓  │
│ CANCEL  PAIRS  DESELECT  SAVE│
└──────────────────────────────┘
    (F1)   (F2)   (F3)   (F4)
```
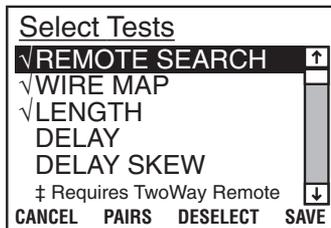
5. Press PAIRS (F2) to select which wire pairs will be included in the tests (twisted-pair cables).

```
┌─────────────────────────────┐
│ Select Pairs:               │
│ √  ▓PAIR 1   (1-2)▓         │
│ √   PAIR 2   (3-6)          │
│ √   PAIR 3   (4-5)          │
│ √   PAIR 4   (7-8)          │
│     SHIELD                  │
│ CANCEL  TESTS  DESELECT  SAVE│
└─────────────────────────────┘
```

(F1) (F2) (F3) (F4)
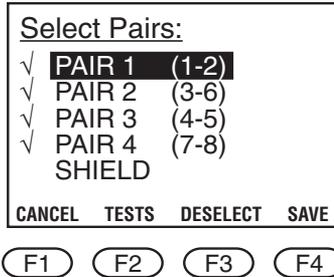
6. Press SELECT/DESELECT (F3) to choose wire pairs and shield.

7. Press SAVE (F4) to save the custom standard. To cancel, press CANCEL (F1).

8. The name of the test standard that was copied, preceded by an asterisk, will be displayed.

   If you want to change the name, move through the name with the LEFT and RIGHT keys, and select new characters with the PREV and NEXT keys.

```
┌─────────────────────────────┐
│                             │
│     ENTER CABLE NAME        │
│                             │
│   (Press ENTER to Save)     │
│                             │
│    * CAT5 Basic Lin▓k▓      │
│                             │
│ LEFT    PREV    NEXT   RIGHT │
└─────────────────────────────┘
```

(F1) (F2) (F3) (F4)
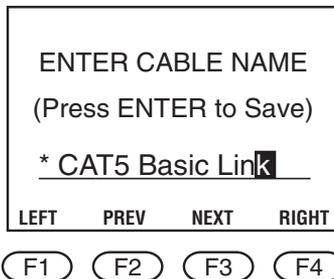
9. Press ENTER to save the custom cable test standard.

NOTE

When using the SCAN-LAN VI testers, matching custom cable definitions must be created on both units.

Appendix B: Common Cable NVP Values

The SCAN-LAN VI uses the following default NVP values:

Cable Test Standards	Default NVP
Category 5 Basic Link	72%
Category 5 Channel	72%
Category 4 Basic Link	66%
Category 4 Channel	66%
Category 3 Basic Link	62%
Category 3 Channel	62%
Token Ring STP	78%
Token Ring 4 UTP	60%
Token Ring 16 UTP	69%
10BASE-T	62%
100BASE-TX	72%
100BASE-T4	58%
TP-PMD	72%
TP-PMD Rev	72%
ScTP Class C	62%
ScTP Class D	72%
ATM 155 Mbps	72%
FTP 120 Ohms	72%
ScTP Class C	62%
ScTP Class D	72%
TP-PMD Rev	72%
ATM 155 Mbps	72%
FTP 120 Ohms	72%
ISO 11801 Class C	62%
ISO 11801 Class D	72%

The following table lists the characteristic impedance and nominal NVP for several manufacturers' cable types.

Manufacturer	Part No.	Category	Impedance (Ω)	NVP (%)
Alcatel	530102	3	100	65
Alcatel	230146	3	100	65
Alpha	9304C	3	100	64
Alpha	9304F	3	100	62
AT&T	1010A	3	100	67
AT&T	1024A	3	100	67
AT&T	2010A	3	100	70
Belden	1154A	3	100	60
Belden	1155A	3	100	62
Belden	1229A	3	100	69
Belden	1245A	3	100	69
Belden	1250A	3	100	62
Berk-Tek	LAN-Grade PL PVC	3	100	58
Berk-Tek	LAN-Grade PL FEP	3	100	72
Berk-Tek	LAN-Grade NP	3	100	69
Brand-Rex	CMP-00026/4F	3	100	60
CommScope	3504	3	100	68
Alpha	9404C	4	100	67
Alpha	9404F	4	100	73
AT&T	2041A	4	100	75
Belden	1455A	4	100	72
Belden	1457A	4	100	75
Belden	1555A	4	100	72
Belden	1456A	4	100	71
Belden	1458A	4	100	75
Brand-Rex	CMP-00025/4F	4	100	71-72
CommScope	4504	4	100	68
CommScope	45N4	4	100	66
AT&T	1061	5	100	70
AT&T	2061	5	100	75
Belden	1583A/B	5	100	72
Belden	1585A/B	5	100	75

SCAN-LAN VI

Manufacturer	Part No.	Category	Impedance (Ω)	NVP (%)
Berk-Tek	HYPER-Grade PL	5	100	72
Berk-Tek	HYPER-Grade NP	5	100	69
Berk-Tek	LANmark PL	5	100	72
Berk-Tek	LANmark NP	5	100	70

Appendix C: Optional Accessories

The following accessories may be ordered separately from Black Box.

ACCESSORY	PART NO.
Modular Jack Performance Module	TS692
Coax Performance Module	TS693
Battery Eliminator, Rechargeable NiMH	TS694
Carrying case, softside	TS695

Appendix D: Cable Replacement Procedure

D.1 General

The Modular Plug Performance Module shipped with your SCAN-LAN VI features a user-replaceable test cord. This Performance Module is a critical part of a SCAN-LAN VI. The SCAN-LAN VI uses frequencies up to 100 MHz, where 1 inch of wire is a significant part of a wavelength. Proper wire preparation and pair twisting is extremely important to preserve measurement accuracy. Follow the procedures carefully including re-calibration and testing.

D.2 Equipment

CABLE REQUIRED

Preferred: Pre-tested replacement cable from Black Box. These cables have been tested for Near-End Crosstalk and other critical parameters and have had wire ends prepared for direct installation.

Or: EIA/TIA T568A Category 5 patch cord, 8-ft. length, cut in two

Or: 4-ft. Category 5 patch cord, with one connector removed.

TOOLS REQUIRED

- Tie wrap—approximately 0.14 inch wide x 3 inch minimum length (3.6 mm x 7.5 cm)

- Screwdriver—flat blade 0.10 inch (2.5 mm)

- Side-cut pliers (dikes)

- Wire-stripping tool

- Knife.

- Soldering tools

- Needle-nose pliers.
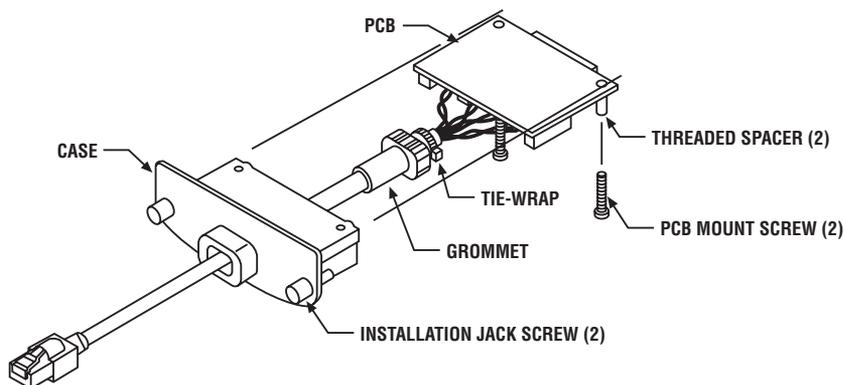
**Figure D-1. Performance Module Disassembly.**

D.3 Disassembly

1. Remove the Performance Module from the main body.

CAUTION

Removing the Performance Module exposes static-sensitive electronics inside the main body. Ground yourself appropriately to avoid damage.

For the steps listed below, refer to Figure D-1.

2. Remove the two $\frac{1}{16}$ inch 4-40 pan-head screws from the Performance Module with a flat-blade screwdriver.

3. Work the grommet through the hole in the case toward the circuit board. Move the grommet and the circuit board until both are free of the case.

4. Make notation of old wire attachments, including color versus position, number and direction of twists, and approximate lay in the case.

5. Remove individual wires by unscrewing their terminals with the screwdriver. For easy re-assembly, fully open the terminal barrels, using six full turns.

6. Note the location of the tie wrap on the old cable and then cut away the tie wrap without cutting the grommet.

7. Remove the grommet from cable and save for reuse.

D.4 New Cable Preparation

NOTE

This procedure assumes that you are using EIA/TIA T568B type patch cord. See Table D-1 for other possible configurations. (If changing cable types it may be necessary to contact Technical Support for calibration assistance.) Read all instructions before starting cable preparation.
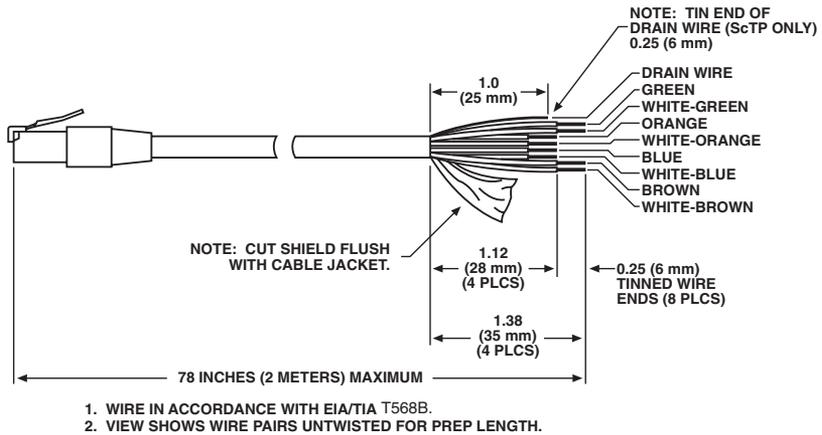

Figure D-2. Cable Preparation per EIA/TIA T568B.

1. Slide the plastic case and then the grommet onto the new cable.

2. Slit the jacket lengthwise 1⅜ inches (35 mm). With ScTP, cut the foil shield back to the jacket, leaving the drain wire intact. Pull the jacket away and then cut it off close to the bundle.

NOTE

Observe carefully the direction of the wire's twist. Proper installation requires this same twist direction right up to the screw terminals. When viewed from the end, most wire twists clockwise as it approaches the wire's end.

3. Arrange the cable and wire pairs as shown in Figure D-2. Do not untwist the pairs any more than required to strip the wire ends.

4   Cut the two inner wire pairs (orange and blue for EIA/TIA T568B) to 1⅛ inches (28 mm) from the jacket.

5. If using ScTP, cut the bare drain wire to 1 inch (25 mm).

6. Remove insulation ¼ inch (6 mm) from the end of each wire and twist to capture all strands. Optionally, tin the ends to capture all strands.

7. Re-twist each wire pair in their original direction. Use two or three full twists for the two outer pairs and one or two twists for the two inner parts.

D.5 Reassembly
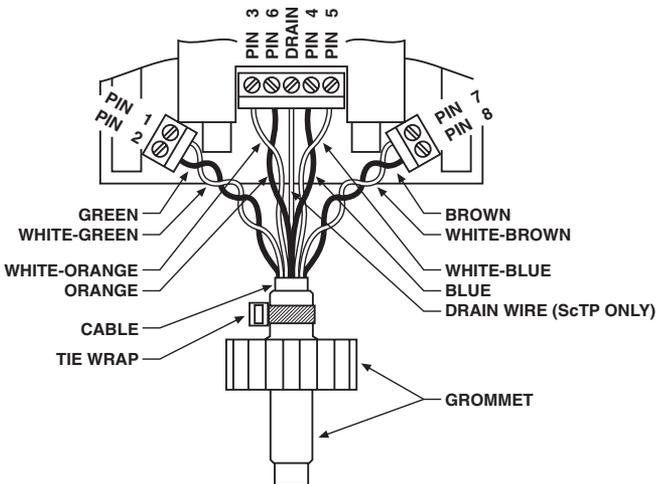

COLORS PER T568B

Figure D-3. UTP Cable Assembly.

1. Insert *each wire* into its terminal and tighten screw until snug (see Figure D-3). If you're using ScTP, connect the drain wire to the center screw terminal of the center terminal strip.

2. Check to see that there are no stray wire strands outside terminal clamps and make sure all wires are properly tightened into their terminals.

3. Make sure that each pair twist is correct, and that the four wire pairs exit radially from the cable jacket as before. Rotate the entire cable so the fan of wires is flat and parallel to the circuit board.

4. Slide the grommet until $\frac{1}{32}$ inch (0.8 mm) or less of cable jacket is exposed (see Figure 1-1). Rotate the grommet so that its flats are parallel with the circuit board when the fanned wires are flat to the circuit board.

    Install new tie wrap centered on grommet sleeve as shown in Figure D-3. When the tie wrap is finally tightened, its ratchet box should be approximately in the plane of the wire fan.

5. Tighten tie wrap as much as possible (until wrap material begins to stretch). Cut off excess tie wrap.

6. Carefully guide the grommet and circuit board into the case. Once the cylindrical neck on the grommet is through the hole, use the neck to pull the grommet into place. The twisted pairs will bunch up when properly installed. If necessary change their positions to avoid pinching.

NOTE

If using ScTP, the drain wire must not short against the circuit shield nor the case (if case is copper painted). Shorten the drain wire by cutting as required to accomplish clearance.

7. Reinstall the 4-40 screws from the open side of the case. Make sure the screws extend through the circuit board and into the plastic of the case.

8. Reinstall the Performance Module in the SCAN-LAN VI body by alternately turning each knurled thumbscrew a small amount or turning them simultaneously. Only tighten these screws finger-tight.

9. Connect the remote and run the WIREMAP test using the CAT 5 Basic Link Cable standard to make sure the new cable was installed correctly. (If the 12/36 pairs are crossed you probably wired up a 568B cable as a 568A or vice versa. Swap the Orange and Green pairs. See Table D-1.)

D.6 Recalibration

1. **Calibrate Performance Module.** Follow the procedures in **Chapter 10** for Performance Module Calibration.

NOTE

In addition to calibrating, this step checks the NEXT to ensure that your new cable assembly is similar in quality to factory specifications. If your assembly fails this test, re-examine the twisted pairs as they enter the screw terminals. Try twisting the wires tighter and make sure the twists extend as close as possible to the screw terminals. Sometimes moving the pairs is all that is required. Many CAT 5 patch cables have too much NEXT due to the way they are terminated at the plug end. You may need to try several before finding one that passes this test. Pre-tested cables are available from Black Box.

2. **Calibrate Remote.** Follow the Remote Unit Calibration procedure, also in **Chapter 10**.

3. **System Check.** Check your SCAN-LAN VI performance by turning the dial to EXTENDED FUNCTIONS. Run Self-Test. All results should read PASS. Run Pair Reversal Test. Results should read PASS.

Table D-1. Replacement Cable Connections

Terminal Blocks	J2		J3					J4	
Wire-Map Number	2	1	3	6	S (DRAIN)	4	5	7	8
Type	**Wire Connections**								
T568A	Pair 3		Pair 2			Pair 1		Pair 4	
UTP	Green	White-Green	White-Orange	Orange		BLue	White-BLue	White-BRown	BRown
T568B *	Pair 2		Pair 3			Pair 1		Pair 4	
UTP	Orange	White-Orange	White-Green	Green		BLue	White-BLue	White-BRown	BRown
* If a T568B UTP cable is used, use the T568B wire connections.									
T568A	Pair 3		Pair 2			Pair 1		Pair 4	
ScTP	Green	White-Green	White-Orange	Orange	Drain wire	BLue	White-BLue	White-BRown	BRown
110	Pair 3		Pair 2			Pair 1		Pair 4	
to T568A	Green	White-Green	White-Orange	Orange		BLue	White-BLue	White-BRown	BRown
110	Pair 2		Pair 3			Pair 1		Pair 4	
to T568B	Orange	White-Orange	White-Green	Green		BLue	White-BLue	White-BRown	BRown
BIX	Pair 3		Pair 2			Pair 1		Pair 4	
to T568A	Orange	Blue	Black	Yellow		Red	Green	Brown	Gray
BIX	Pair 2		Pair 3			Pair 1		Pair 4	
to T568B	Yellow	Black	Blue	Orange		Red	Green	Brown	Gray
ALL-LAN	Pair 3		Pair 2			Pair 1		Pair 4	
UTP T568A	Green	White-Green	White-Orange	Orange		BLue	White-BLue	White-BRown	BRown
ALL-LAN	Pair 3		Pair 2			Pair 1		Pair 4	
ScTP T568A	Green	White-Green	White-Orange	Orange	Drain wire	BLue	White-BLue	White-BRown	BRown

Glossary

AC (Alternating Current) — A voltage or current of alternating polarity.

Access Unit — A unit that allows multiple-device attachment at a central location.

Address — An identification code assigned uniquely to each device or workstation connected to a network.

Analog — A continuously varying signal that can take on any voltage or current level.

Anomaly — An impedance discontinuity causing an undesired signal reflection on a transmission cable.

ANSI — American National Standards Institute.

ARCNET (Attached Resources Computing Network) — A token bus developed by Datapoint.

ATM (Asynchronous Transfer Mode) — A high-speed packet-switching method.

Attenuation — Reduction in the strength or power of a signal as it travels over the length of a cable.

Attenuation to Crosstalk Ratio (ACR) — An indication of the reliability of data communications through a network. It is a computed value based upon the measured values of attenuation and NEXT.

AUI (Attachment Unit Interface) — Connects the transceiver and Network Interface Card in 10BASE5 networks.

AWG (American Wire Gauge) — The thickness of the conductor in a cable.

Backbone — A central local area network used to interconnect two or more other local area networks.

Balun — A cable-impedance-matching RF transformer.

Bandwidth — The difference between the highest and lowest frequency available on a channel to effectively transmit signals.

Barrel Connector — Connector that joins two sections of a coax cable.

Baseband — A frequency band that uses the complete bandwidth of a cable down to zero frequency for the transmission of a single channel of data.

Basic Link — As defined by EIA/TIA TSB-67, the horizontal wiring link from the work-area telecommunications outlet (wallplate) to the horizontal cross-connect. Includes equipment cords at each end for connection to test instrumentation.

BER (Bit Error Rate) — The ratio of received bits in error to the total received bits.

Binary — A signaling method that uses two states, either zero or one.

Bit — Binary digit, the smallest unit of data.

Bits per Second (bps) — A measurement of the speed of data transmission.

Block — A connection system for cross-connecting twisted-pair telecommunication cable. Also called punchdown block. Common types include AT&T 110 and 66 blocks.

BNC — Bayonet Neil Concelman connector, the connector used for coaxial cable in a Thin Ethernet network.

Bridge — Attachment device that forwards packets from one LAN segment to another based upon destination MAC address.

Broadband — A wide-bandwidth signaling method that allows a cable to carry several different kinds of transmissions simultaneously such as voice, video, and data on one cable.

Bus — A configuration in which nodes on a network are interconnected and communicate.

Byte — Eight data bits.

Cable — A medium that is used to interconnect two or more devices for communication.

Capacitance — The ability to store an electrical charge between two surfaces, measured in farads.

CDDI — Copper Distributed Data Interface, a variation of the FDDI standard (ANSI X3T9.5) adapted for 100-Mbps data transmission on twisted-pair cable. Also called TP-PMD.

Channel — As defined by EIA/TIA TSB-67, the entire horizontal wiring link connecting end devices in the work area to the hub/concentrator in the wiring closet. Includes user's equipment cords at both ends and horizontal cross-connections (see **Appendix A, Test Standards**, Figure A-1).

Characteristic Impedance — An inherent characteristic of the cable. A measure of resistance to AC current flow (high frequency) by a long cable.

Cheapernet — A nickname for 10BASE2 or ThinNet, a coax-based Ethernet network.

Coaxial (Coax) Cable — A cable that contains a single center copper conductor surrounded by insulation material and one or more layers of metal foil or braided-wire mesh plus an outer protective jacket.

Collision — The result of two stations simultaneously attempting to transmit data on a shared network transmission medium.

Concentrator — A piece of LAN equipment that allows multiple network devices to be connected to the network cabling system through a central point. Also called a hub.

Connecting Block — An interconnecting point for several LAN segments.

Crossed Pair — A twisted-pair wiring error in which a wire pair on one connector of the cable is wired to a different pair on the other end of the cable.

Crosstalk — The coupling of a signal between pairs of a multiple-pair cable.

CSA — Canadian Standards Association.

CSMA/CD (Carrier Sense Multiple Access/Collision Detection) — Ethernet media access method in which stations transmit on a bus whenever the medium is available and re-transmit when collisions occur.

Decibel (dB) — A logarithmic unit of measure used to express the amplitude ratio between two signals. $dB = 20 \log (Vsignal2/Vsignal1)$.

DC (Direct Current) — A zero-frequency or constant-level signal.

DECnet — A proprietary Ethernet LAN developed by Digital Equipment Corporation.

Delay — A measure of the time electrical signals take to propagate from one end of the cable to the other end.

Delay Skew — The difference in propagation delays from one cable pair to another.

Differential Manchester Encoding — A digital signaling technique with a transition in the middle of the bit to provide clocking.

Drop Cable — In 10BASE5 networks, a cable connecting a workstation network interface card (NIC) with the transmission medium. Sometimes called Attachment Unit Interface (AUI) cable.

EIA — Electronic Industry Association.

EMI (Electromagnetic Interference) — Leakage of electromagnetic energy outside of a transmission medium.

Ethernet — A high-speed local area network using the Carrier Sense Multiple Access with Collision Detection (CSMA/CD) media-access method.

Far End Crosstalk (FEXT) — Crosstalk that is measured at the opposite end of a cable from where the signal is injected.

Fault — Any accidental condition that causes a component to fail.

FCC—Federal Communications Commission.

FDDI (Fiber Distributed Data Interface) — A network standard (ANSI X3T9.5) that defines a 100-Mbps token-ring network using optical fiber for data transmission over distances of several kilometers.

Fiber — A transmission medium designed to transmit data in the form of light pulses.

File Server — A high-capacity file-storage device that computers on a network can access to retrieve files.

Foil Twisted Pair (FTP) — See *Screened Twisted Pair.*

Frame — A unit of transmission in some LANs such as Token Ring.

Frequency — Rate of AC signal alternation, defined in Hertz (cycles per second).

Full Duplex — Transmission of data in both directions at the same time.

Gateway — A device that interconnects two or more networks that may use different protocols and media.

Hertz (Hz) — Unit of measure for frequency in cycles per second (cps).

Horizontal Cable — The part of a building's cabling that extends from and includes the telecommunications outlet in the work area to the telecommunications (IDF) closet on the same floor.

Hub — A piece of LAN equipment that allows multiple network devices to be connected to the network cabling system through a central point. Also called a concentrator.

I/O — Input/Output.

IDF (Intermediate Distribution Frame) — The distribution point where vertical backbone cable is connected to the horizontal cables.

IEEE — Institute of Electrical and Electronic Engineers.

Impedance — A frequency-dependent parameter defined by the ratio of the AC Voltage to Current across a circuit element.

Impulse Noise — Non-repetitive electrical spikes or pulses caused by external electromagnetic fields.

Inductance — The ability to store a magnetic field across a conductor measured in Henries (H).

Insulation — A non-conductive material used to isolate conductor surfaces.

Internetworking — Communication among devices across multiple networks.

ISO — International Organization for Standardization.

Jabber — A network fault condition where one station is continuously transmitting or transmits illegal packets of length greater than 20 milliseconds.

Jack — EIA-standard modular connector for connecting twisted-pair cables at a wall plate or patch panel.

Jacket — The outside protective covering of a cable.

Jitter — The time-based variation of the received data bits.

Jumper Cable — Short cable for interconnecting connecting blocks or patch panels. Also called patch cord or patch cable.

LAN (Local Area Network) — A data-communication network that provides high-speed communication in a moderate-size geographic area.

Link — The communications medium connecting office equipment to the hub or concentrator in the wiring closet.

Link Pulse — A single-bit test pulse transmitted periodically between hubs and workstations on 10BASE-T segments to verify integrity.

Lobe — The cable segments that connect a device to the Multi-Station Access Unit (MSAU) for Token Ring.

MAC (Medium Access Control) — The method of determining how stations access the medium at any time.

MAC Address — A unique identification number assigned to each station connected to a network. Sometimes called Station Address.

Main Cross-Connects — The connections between external telecommunications lines, interbuilding backbone cable, common communications equipment (PBX), and internal backbone cable. Also called Main Distribution Frame.

Main Distribution Frame (MDF) — See *Main Cross-Connects.*

Medium — The physical carrier of the data being transmitted (for example twisted-pair cable, coaxial cable, or fiber).

Medium Attachment Unit (MAU) — Device used in Ethernet networks to couple a station or hub to the transmission medium.

Modular Jack — EIA-standard receptacle connector used for connecting twisted-pair cables at a wall plate, patch panels, and station equipment. Sometimes called RJ-45 jack.

Modular Plug — EIA-standard connector used to terminate twisted-pair patch cables and equipment cables. Sometimes called RJ-45 plug.

MSAU (Multi-Station Access Unit) — A Token Ring wiring center for network attachment.

MTBF (Mean Time Between Failures) — The average operation time to component failures.

Near-End Crosstalk (NEXT) — Noise coupled between two twisted pairs measured at the same end of the cable as the disturbing signal source.

Network — A collection of nodes interconnected by a medium.

Network Interface Card (NIC) — The circuit card that interfaces a station to the network.

Network Manager — A program that is used to monitor, manage, and diagnose the problems of a network medium.

Node — Connecting point on a network. A station or device on a network.

Noise — Any random disturbance in a communications system that interferes with the integrity of the transmitted data.

NVP (Nominal Velocity of Propagation) — The speed of signal propagation through a cable, expressed as a percentage of the speed of light in a vacuum.

Ohm — The unit of measurement for resistance.

Open — A break in the connection between the two ends of a wire or cable.

OSI (Open Systems Interconnect) — A seven-layer architecture that serves as a model between systems.

Packet — A group of bits in a defined format, containing data and control information used for transmission from one node to another.

Pair — Two wires in a multi-wired cable that are used as a single transmission path.

Passive Concentrator — A type of Multi-Station Access Unit (MSAU) used to connect stations to a Token-Ring network without signal regeneration.

Patch Cable — A short length of cable with modular-plug connectors at both ends that is used to complete a cable segment.

Patch Panel — An organized concentration of modular-cable connectors that facilitates the interconnection of cable segments.

Physical Layer — The layer that provides the mechanical, electrical, and functional connection over a transmission medium.

Plenum — An air-handling space inside a building. Plenum cable is certified for installation in these open spaces.

Plug — A connector designed to insert into a receptacle (jack) of a socket.

Port — An access point for data I/O.

Power Sum NEXT — A sum of the pair-to-pair NEXT coupled from all adjacent pairs in a cable.

Protocol — A standard set of rules specifying the format, timing, and sequencing for data transmission.

Punch-Down Block — A block of mechanical devices that is used to connect twisted-pair cable.

PVC — Polyvinyl Chloride, a standard coating used on cables.

Receiver — The portion of a station or node that receives the data communication.

Repeater — A device that regenerates the data signal, used to extend the network length.

Resistance — An electrical element that impedes the flow of current, measured in ohms.

Reversed Pair — Twisted-pair wiring error in which the polarity of one wire pair is reversed at one end of the link. Also called tip/ring reversal.

Ring — A LAN topology in which data is passed from station to station via a loop. Also, the designation for one conductor of a twisted-pair cable.

RJ-45 (Registered Jack) — An eight-position telephone-type connector.

Router — A device that interconnects two or more LAN subnetworks and relays packets based upon destination network addresses.

Runt Packet — An Ethernet packet that is shorter than the minimum valid length (64 bytes).

Screened Twisted Pair (ScTP) — Cable constructed of four twisted-wire pairs surrounded by a metal foil shield and an outer protective jacket. Also called Foil Twisted Pair (FTP).

Sheath — The outside covering of a cable(s).

Shield — A conductive material that is used to enclose a data cable to decrease emissions and noise susceptibility.

Shielded Twisted Pair (STP) — Cable constructed of up to four twisted-wire pairs, each pair individually surrounded by a metal foil, and all wire pairs surrounded by a metal shield plus an outer protective jacket.

Short — A near-zero-resistance connection between two wires of a cable.

Signal to Crosstalk (SCR) — The logarithmic ratio of the received signal to any signal that is coupled into the pair.

Signal to NEXT (SNR) — The logarithmic ratio of the received signal to the near-end crosstalk that is coupled into the pair.

Signal to Noise (SNR) — The logarithmic ratio of the received signal to any noise.

Silver Satin — Flat untwisted telephone-station wire. Also called quad wire.

Split Pair — A twisted-pair wiring error in which pin-to-pin continuity is maintained, but physical pairs are separated.

Star — A physical layout of a LAN that uses a centralized wiring location.

Starlan — A LAN network developed by AT&T.

Station — A communication device or node attached to a LAN.

STP — Shielded Twisted Pair.

Tap — A connection to a coax cable that allows access to the network.

T Connection — A three-way BNC-type connector used to connect coaxial cable to a station network interface card in a 10BASE2 Ethernet network.

TCP/IP (Transmission Control Protocol/Internet Protocol) — A protocol originally defined by the U.S. Department of Defense.

TDR (Time-Domain Reflectometry) — A technique for measuring cable lengths by timing the duration between an incident pulse and the reflected pulse from an impedance discontinuity on a cable.

Telecommunications Closet — A room used to interconnect horizontal cable links to communication distribution equipment. Also called wiring closet.

Terminator — A connection to the end of a cable which is intended to match the characteristic impedance of the cable.

ThickNet — 10BASE5 Ethernet.

ThinNet — 10BASE2 Ethernet. Sometimes called Cheapnet.

TIA — Telecommunications Industry Association.

Tip — One conductor of a twisted-pair cable.

Token — A sequence of bits transmitted over a Ring or Bus network used to signify permission to transmit.

TP-PMD (Twisted Pair Physical Media Dependent) — A variation of the FDDI standard (ANSI X3T9.5) adapted for 100-Mbps data transmission on twisted-pair cable. Also called CDDI.

Traffic — Data-transmission activity on a network.

Transceiver — A station-access unit for coax networks.

Transceiver Cable — A cable used to attach a device to an Ethernet segment.

Tree — A LAN topology where the cable branches from a headend.

Twinaxial Cable — A cable typically used for connecting IBM® systems 36/38 and AS/400® equipment. Consists of two center copper conductors surrounded by insulation material, a braided wire mesh shield, and an outer protective jacket.

Twisted Pair — A transmission medium using a pair of wires that are twisted together.

UL® — Underwriter's Laboratories.

UTP (Unshielded Twisted Pair cable) — Cable constructed of four twisted wire pairs surrounded by an outer protective jacket.

Voice Grade Cable — A lower quality or category of cable used to carry telephone communication.

Voltage — The potential difference between two points.

Wide Area Networks (WAN) — Networks, usually in the public domain, that tie together widely separated computing devices or LANs.

Wiring Closet — A room used to interconnect horizontal cable links and locate communication distribution equipment. Also called telecommunications closet.

Word — Data bits assembled in a convenient processing size.

Workstation — A user's computer that can be connected to a network.

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